U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

SOIL SURVEY OF DICKENS COUNTY TEXAS

BY

WILLIAM T. CARTER, IN CHARGE, B. H. HENDRICKSON AND W. W. STRIKE

[Advance Sheets—Field Operations of the Bureau of Soils, 1922]

WASHINGTON
GOVERNMENT PRINTING OFFICE
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[PUBLIC RESOLUTION—No. 9]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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SOIL SURVEY OF DICKENS COUNTY, TEXAS

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DESCRIPTION OF THE AREA

Dickens County is located in northwestern Texas. The western boundary of the county is about 120 miles east from the New Mexico State line, and the northwest corner lies about 60 miles southwest of the southwest corner of Oklahoma. It is about square, with sides measuring approximately 30 miles. Planimeter measurements give an area of 893 square miles, or 571,520 acres.

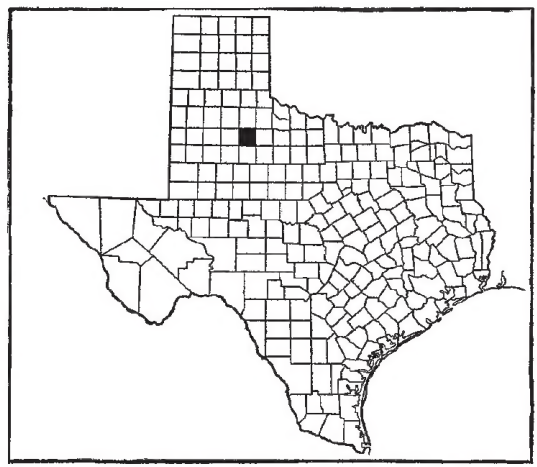

FIG. 13.—Sketch map showing location of the Dickens County area, Texas

Dickens County lies mostly within the Central Plains region of Texas. A small area in the northwestern part of the county lies within that subdivision of the Great Plains known as the Llano Estacado or High Plains. The rest of the county, constituting by far the greater part, occupies the Lower Plains. Therefore the two chief physiographic subdivisions of the county may be referred to as the Lower Plains, and the Llano Estacado or High Plains, but in no case is the difference in elevation sufficient to modify to any appreciable extent the climatic conditions.

The lower plain varies considerably in the details of relief and elevation. In the southern part of the county the topography is smooth to slightly rolling, owing to dissection by shallow valleys. Occasional mesas and buttes, less than 250 feet in height above the surrounding country, stand on the general upland surface. The elevations range between 2,000 and 2,500 feet. The Low Plains, in the northern and western parts of the county, range from about 100 to 250 feet higher than the general level of the Lower Plains in general. The topography is gently rolling, with slight modification by the wind-blown sand. In the southeastern part of the county along Croton Creek the topography is quite rough, owing to thorough dissection. Another belt of rough land, more or less dis-

continuous, stretches along the boundary between the two main plains. Still another area of rough land modifying the lower plain but less rough than the preceding areas lies in the eastern part of the county.

The High Plains area lies in the northwestern corner of the county. It is a flat treeless plain with an occasional narrow steep-sided canyon near its eastern border.

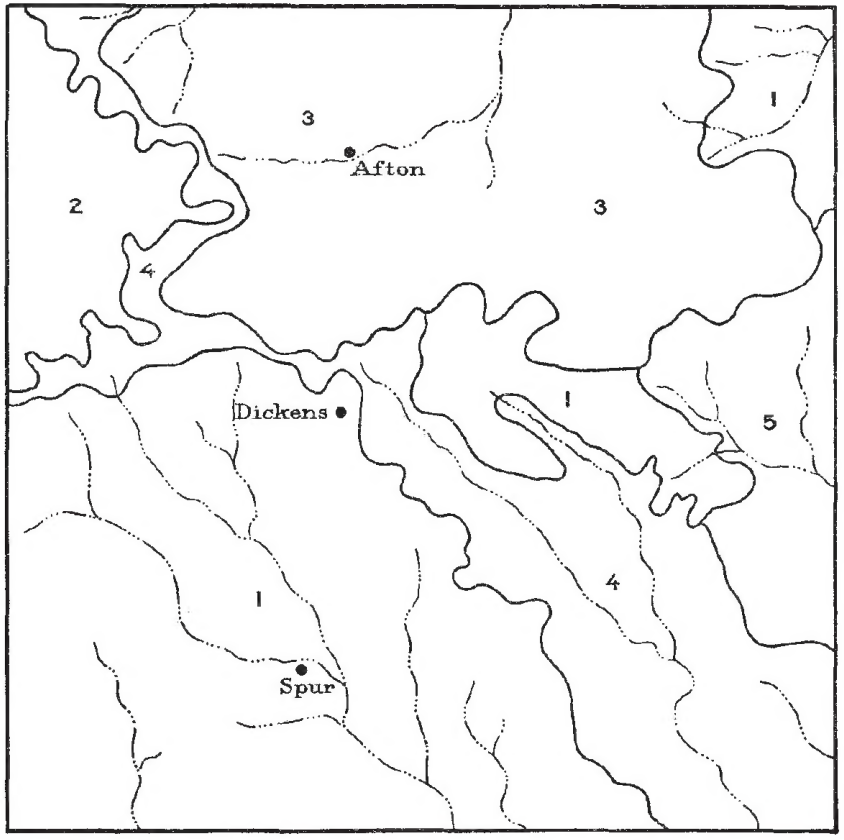

FIG. 14.—Sketch map showing the principal topographic divisions of Dickens County. (1) Rolling plains; (2) Flat high plains, or plateau; (3) Rolling secondary plateau; (4) Rough broken land; (5) Moderately broken land

The accompanying sketch map (Fig. 14) shows the approximate location and extent of the various topographic divisions of Dickens County.

The elevation in Dickens County ranges from approximately 2,000 feet to about 2,800 feet above sea level. The lowest land is in the southeastern part along Croton Creek, while the highest is on the High Plains in the northwestern part. The general or regional slope of the county is toward the southeast. The elevation at Dickens is said to be 2,590 feet and at Spur about 2,300 feet above sea level.

Dickens County has good drainage. Some land is so flat as to retard the flow of water, but this is generally an advantage in a region of light rainfall.

Approximately the southern half of the county is drained by tributaries of the Salt Fork of the Brazos River, the northeastern part by the North and South Forks of the Wichita River, and the northwestern part by tributaries of the South Pease River. The streams named do not flow through the county, but parts of their drainage basins lie within its bounds.

The larger streams are dry sand beds most of the time. The channels shift from place to place over the narrow sandy beds, according to volume of flood water which comes down at irregular periods. The smaller drainage ways are dry during the greater part of the year, though small water holes, which are fed by springs, occur in many places. The channel of Dockum Creek is poorly defined in places, owing to the filling in with sediments during heavy rains. Overflows rarely occur on the stream bottoms, though the bottom lands are occasionally covered with water for a short time just after heavy rains. As a rule the stream channels lie rather deep, 5 to 15 feet below the surface of the adjacent bottom lands, and at first glance the adjacent lands in many places may not be recognized as stream bottoms.

The county is best described as treeless. In places in the rolling plains there is an open growth of low mesquite trees. In the sandy country some shin oak bushes and trees, ordinarily only 2 or 3 feet high, but in places reaching a height of 5 to 8 feet, occur. In areas of broken land there is a very scattered growth of cedar (juniper). The important vegetation consists of grasses and broom sedge.

Dickens County was organized about 1880 and at that time had 28 inhabitants. The first settlers of the region were ranchers coming from other parts of Texas, who utilized the range for raising and grazing cattle. In 1890 the population of the county had increased to 295; in 1900 it was 1,151; in 1910, 3,092; and in 1920, 5,876.

The present population consists mostly of native whites from the older sections of Texas, though some are from other States. Very few persons of foreign extraction live in the county, except a few Mexicans, engaged chiefly in farming. The colored population is small, though there is a temporary influx of negroes during the cotton-picking season. These return to eastern Texas after the crop is gathered. The population is all classed as rural, there being no towns of more than 2,500 people. The density of population is greatest in the southern part of the county, near the railroad. The High Plains section is well settled, averaging one family or more for every quarter section of land. The central-northern part of the county also is quite thickly settled. The eastern part is most thinly settled, the land being mainly in large ranches.

Spur is the principal town and most central shipping point in the county. It has a population of about 1,200. Dickens, the county seat, is a small town in the central part of the county and not on a railroad. Afton and McAdoo are villages in the northern part of the county.

Railway facilities are afforded by the Wichita Valley Railway, which extends a few miles into the southern part of the county. This

road makes a connection with a number of other lines at Stamford and Wichita Falls. A branch of the Santa Fe Railway, terminating at Crosbyton, some 15 miles from the northwestern part of the county, is used by some of the farmers in that section as a shipping point, and some farmers in the northern part of the county utilize Roaring Springs in Motley County as a shipping point.

Most of the roads in Dickens County are earth roads, some of which are graded. All are in good condition for automobile and wagon traffic, except just after extended rainy periods, when they are muddy. Several roads are graveled highways in excellent condition. Local gravel deposits supply good road-building material.

All sections of the county have telephone service and a large part of the county rural mail delivery. Churches and schools are located conveniently throughout the settled parts.

Spur is the principal local market for farm products, though Crosbyton and Roaring Springs also receive some of the products. Fort Worth and Kansas City are the principal livestock markets. Wheat, grain-sorghum seed, peanuts, and cream are shipped to outside markets when the production exceeds local requirements. One of the Texas agricultural experiment stations (Substation No. 7) is located at Spur. This station has been of great benefit to the agricultural interests of western Texas.

CLIMATE

Dickens County lies in the plains region, where the climate is mild and healthful. The humidity is low and the altitude comparatively high, and the climate is invigorating. The average yearly rainfall is rather low, but is normally most abundant during the growing season. Although some extended dry seasons occur, a general crop failure is seldom caused by lack of moisture. A very large percentage of the days are clear, the atmosphere is dry, and evaporation is rather high. The summers, though hot, are not oppressive and heat prostrations are unknown. Some severe cold spells occur during the winter, these being due to north winds, known as "northers," which are the southerly extensions of cold waves from the north and west. These may last several days. Between the "northers" the weather is cool but not cold.

The mean annual precipitation is 22.55 inches. The annual rainfall varies from year to year, and in some years there are extended periods of dry weather. The lowest recorded rainfall was 10.92 inches, and the highest 35.61 inches. The lightest precipitation normally is during the winter months, with a monthly average of less than 1 inch. From May to October, inclusive, the average is somewhat over 2 inches per month, and the mean distribution over this period is comparatively even. Local showers and thunderstorms are the usual form of rain during warm weather. Occasional hailstorms occur, damaging crops over small areas. The snowfall is very light and remains on the ground only a short time, usually only two or three days.

The mean temperature for the winter is 41.9° F., and for the summer 80.3° F. The average length of the growing season is 207 days. The average date of the last killing frost in spring is April 5,

and that of the first in the fall October 29. Crops are rarely injured by early fall frosts. Fruit is subject to injury by late spring frosts.

Wind velocities are occasionally high, more frequently during the spring than at other times of the year. Some of the sandy soils drift rather badly, and these winds may cause some damage to young crops on such soils.

The following table, compiled from the records of the Weather Bureau station at Spur, gives the normal monthly, seasonal, and annual temperature and precipitation:

Normal monthly, seasonal, and annual temperature and precipitation at Spur

[Elevation, 2,300 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1914)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	41.2	86	6	1.03	0.00	1.74
January	40.1	82	−2	.33	.50	.10
February	44.4	90	5	.65	.43	.21
Winter	41.9	90	−2	2.01	.93	2.05
March	50.7	95	9	.98	.28	.25
April	59.9	98	25	2.29	1.26	1.30
May	69.3	105	32	3.25	1.77	12.43
Spring	59.9	105	9	6.52	3.31	13.98
June	78.0	110	43	2.53	.27	1.63
July	82.4	111	51	1.78	1.62	5.18
August	80.6	107	45	2.66	1.47	5.42
Summer	80.3	111	43	6.97	3.36	12.23
September	73.3	105	36	3.10	3.23	1.17
October	62.2	97	20	3.02	.09	5.09
November	50.8	87	10	.93	.00	1.09
Fall	62.1	105	10	7.05	3.32	7.35
Year	61.0	111	−2	22.55	10.92	35.61

AGRICULTURE

The early history of Dickens County is concerned chiefly with the development of stock raising, to which the region was naturally fitted by the abundance of nutritious grasses and the shelter afforded by the topography of the rougher parts of the county. In the later seventies there were a number of large ranching outfits in the county, with individual land holdings comprising many thousands of acres. Within a few years thereafter the entire county was utilized by ranchers engaged in the production of cattle with little other feed than the native grasses. In these early days most of the ranchers grew some sorgo (sweet sorghum) and Johnson grass on the sandy alluvial soils of the valleys for feeding the ranch horses and some of the poorer cattle, as well as some of the more valuable animals during the winter. Later the grain sorghums, milo and kafir, also were produced on the ranches for feeding some of the cattle that required more feed in the winter than was afforded by the natural grasses.

There were very few farmers in the county up to 1900, and the chief crops were sorgo and grain sorghums, which were sold to the ranchers or fed to small herds on the farms. In 1900 the population of the county was only 1,151 and in 1910 it was 3,092, there being only a few thousand acres in cultivation at that time.

Within the last 12 or 15 years the country has been opened up to farmers through the cutting up of some of the large ranches, and during that period, which was ushered in with the building of a railroad into the county in 1909, there has been a decided increase in area of land in cultivation, and new farms are being opened up all the time. The greater part of the land, however, is still utilized for stock raising and there are still a number of large and some small cattle ranches in the county, probably not more than 15 or 20 per cent of the county being cultivated land at the present time.

The first farming communities of any consequence were on the sandy soils in the northern part of the county around Afton and on the creek bottoms in the southern part of the county.

General farm crops are produced. Cotton is grown as a cash crop on most farms. Some grain sorghum is grown on every farm as feed for work stock, and the surplus is sold locally or shipped, so that grain sorghum is in part a cash crop. Sorgo is grown regularly for forage. Some raise wheat and oats, while many raise small patches of corn. Alfalfa, rye, barley, millet, and various other miscellaneous crops are grown in a very small way. Fruits and vegetables are grown everywhere in small home gardens and orchards. Peanuts are grown to a considerable extent on sandy land.

According to the census of 1900 there were 400 acres in cotton in 1899, producing 74 bales; 1,465 acres in corn, yielding 26,320 bushels; and 1,458 acres in coarse forage, giving 3,968 tons. There were only a few acres in all other crops. Animals sold and slaughtered that year had a value of $243,229.

By 1909 the area devoted to cotton had increased to 5,481 acres, yielding 1,021 bales; corn occupied 2,014 acres, producing 14,118 bushels; grain sorghums 2,436 acres, giving 24,056 bushels. That year the value of animals sold and slaughtered amounted to $379,802. The total value of all agricultural products, including animals as above stated, was $544,356.

The present form of varied agriculture has been carried on in Dickens County for the past 20 years, though not attaining any considerable importance until after the advent of a railroad into the county about 1909. It consists in the production of the general farm crops for sale and for home use, with some stock farming and much cattle ranching. Most farmers grow fruit and vegetables for home use and produce milk and butter to supply their needs and the demand of local markets. Some cream is shipped out of the county to butter factories in Fort Worth and other cities.

Cotton is the main cash crop. It occupies a larger acreage than any other crop, probably half of all land devoted to cultivated crops. The census of 1920 gives the cotton acreage as 35,494 acres in 1919, and the production as 17,492 bales. The yield per acre of cotton varies considerably with seasonal conditions, but ordinarily ranges between one-third and one-half bale. In especially good seasons some soils yield 1 bale or more per acre. At the State experiment

station (Substation No. 7) at Spur the yields for six years on Miles clay loam were about three-fifths bale per acre for Mebane cotton, which is the principal variety grown in the county.

The Mebane cotton seems to be very well suited in general to the semiarid conditions of the region. The length of the staple is about 1 inch. Other varieties of longer staple, such as the Lone Star, Acala and Durango, which have a staple of about $1\frac{1}{16}$ to $1\frac{1}{8}$ inches in length, also are being grown with success. These longer staple cottons yield well but not so well on the average as the Mebane. The county is free from boll-weevil infestation. Bollworms have been destructive in places one or two years in rainy seasons. The county seems well suited to the production of cotton.

Next to cotton the grain sorghums are the most important crops in the county. They are grown on every farm. In 1919 they occupied 11,854 acres, yielding 315,934 bushels of grain. Originally kafir was the principal grain sorghum, but at present milo is grown almost entirely. Some feterita also is sown and the acreage devoted to the new grain sorghum, Spur feterita, is being extended, as it gives better yields of grain and the fodder is better than in case of the other sorghums so far tried. Much of the grain is harvested by heading in the field, the stalks being left to be pastured. The dwarf yellow is the variety of milo most extensively grown. The average yield of milo for the county is probably around 30 bushels per acre.

Sorgo is grown on nearly every farm as a forage crop. It makes a splendid roughage, whether grown as a row crop or seeded in drills and cut for hay. It is all fed on the farms. It yields well and withstands dry seasons to a considerable extent. Ordinary yields range from 3 to 6 tons per acre. At the experiment station, near Spur, a yield as high as 11 tons per acre of cured sorgo has been obtained. According to the census, 16,576 acres were devoted to coarse fodder in Dickens County in 1919, yielding 19,541 tons. Doubtless the greater part of this was sorgo. The Sumac or Redtop variety is grown mostly. Plate IX, figure 1, shows a field of cowpeas with sorgo in the background.

Corn is not grown as extensively as the grain sorghums, though many farmers plant small fields. It was grown on 3,518 acres in 1919, yielding 66,949 bushels. It is fed to the farm stock. Corn is a somewhat uncertain crop, as dry weather often lowers the yield. The yield ranges from nothing in a poor season to 20 bushels per acre in fairly good seasons, with slightly higher yields on some of the better soils.

Wheat is grown to some extent in the northwestern and southeastern sections of the county. In 1919 the area in wheat was 1,775 acres, and the production 29,845 bushels. Oats occupied in that year 651 acres and yielded 23,477 bushels. In seasons when moisture conditions are favorable high yields of these grains are obtained, but in seasons following a dry fall and winter the yields are very low. Turkey wheat is the leading variety and the Red Rustproof is the most popular variety of oats. When the fall season is dry little wheat or oats is sown.

Some peanuts are grown on the sandy soils of the county. Ordinarily they yield around 20 to 30 bushels of nuts and 1 ton of hay. The peanuts are sold to oil mills outside the county.

Alfalfa is grown in small acreages in various parts of the county. This crop has been successful on some of the creek-bottom soils and on low-lying soils of the upland. Yields in good seasons range from 3 to 4 tons per acre. So far it has been grown without irrigation. Much larger yields could be obtained with irrigation.

Crops of minor importance include cowpeas, millet, rye, barley, and Sudan grass. Small quantities of broomcorn have been grown successfully. Plate IX, figure 2, shows the possibilities in producing Sudan grass.

The small home orchards include various fruit trees, vine and bush fruits, and berries. The main fruits are peaches, apples, plums, and cherries. Grapes are grown very successfully. The orchard trees are thrifty and yield well in favorable seasons. Late frosts sometimes kill the orchard fruit crop, but good fruit crops are said to be obtained about three years out of five on an average.

Many kinds of vegetables, including melons and sweet potatoes, are produced in home gardens. It is customary to irrigate gardens in dry seasons, the water being supplied by wells.

The value of all the agricultural products in Dickens County in 1919, excepting animals sold and slaughtered, was $4,641,767. The total value of cereals produced was $534,672; other grains and seeds, $4,339; hay and forage, $384,488; vegetables, $32,133; fruits and nuts, $12,068; and all other crops, principally cotton, $3,511,800. The value of dairy products, excluding home use, was $59,617; poultry and eggs, $96,052; and wool, $6,598.

Raising beef cattle is the most important livestock industry. According to the 1920 census there were at that time 18,340 beef cattle in Dickens County, valued at a little more than $1,000,000. The cattle are largely shipped to outside markets as feeders; only a few cattle are fattened. These are fed milo grain, sorgo fodder, and cottonseed meal. Ranching is carried on by some large outfits, and also by some controlling only a few thousand acres. The native grasses are very nutritious and cure on the ground, affording excellent feed during the winter. In seasons when the grass is short and the supply of natural feed inadequate a maintenance ration is fed to ranch cattle. This consists mainly of fodder and grain of the grain sorghums and sorgo, supplemented with cottonseed cake. Some ranchers feed the cake only.

The average area of land required to support a ranch animal varies with the locality and soils; 10 to 15 acres is the usual estimate. The cattle run on the open range the year round and have no shelter except that afforded by the draws and canyons of the rough areas. Much of the range stock is shipped to market when the animals are less than 1 year old. The range stock consists largely of grade Herefords. Some purebred herds are owned and the range bulls are all purebred Herefords. The cattle markets are Fort Worth and Kansas City.

A possible development in the cattle industry is the production of finished animals instead of feeders for the market. The production of the grain sorghums is rapidly increasing in Dickens County, and the strains of these grains are being improved through the efforts of the experiment station at Spur. Taking into consideration the fattening value of these grains and other feeds producible in the

county, it would seem that the opportunity for the combination of raising and fattening cattle is excellent.

There are a few flocks of sheep in the county. These range in size between 1,200 and 1,500 head. Sheep are raised for wool and for meat and have proved quite profitable in the last few years. Sheep are grazed the year round, but are fed a small maintenance ration during the winter.

Hogs are raised on nearly all farms and considerable shipments reach outside markets. The hogs are grazed on whatever green pasture may be available and fed milo grain and corn. Pasturing on alfalfa is practiced with excellent results where this crop is grown. (Pl. X, fig. 1.) The Duroc-Jersey is the leading breed.

Generally speaking, the soil types of flat or nearly flat topography are somewhat more productive than the soils in areas of rolling or sloping surface, where texture and structure are approximately the same. This is due to the slightly higher percentage of organic matter in the flat soils and also to the better supply of moisture, as there is little run-off after rains. The sandy types of soil on rolling areas seem to catch more water and hold it better than those of finer texture and more compact structure, and crops on the rolling sandy soils withstand adverse dry conditions better than on the rolling heavy types.

The soils of the county, in order of their degree of resistance to dry weather conditions, are as follows: (1) Sandy soils with clay subsoils lying on flat land; (2) heavy soils, on flat land; (3) sandy soils on rolling land; and (4) heavy soils on rolling land. Crops suffer most on the heavy soils severely eroded, especially on the red clay loam and sandy clay loam of washed slopes.

Although the extension of agriculture to Dickens County is comparatively recent farmers have learned much concerning the adaptation of their soils for the different crops. Climatic conditions have enforced careful consideration of this question, for though the average annual rainfall is ordinarily sufficient to produce good crops there are seasons when it is scant and every advantage of soil, crop, and moisture conditions must be taken to insure success. Therefore the dry-weather resistance of soils is often considered the most important factor in determining the suitability of a soil for certain crops.

Cotton, the grain sorghums, and sorgo are recognized as the most certain crops under very dry conditions, and these crops are very generally grown. The yields, of course, indicate the most suitable soils for the crops under varying conditions of moisture and dryness. It is well understood that the sandy loams produce the most certain and constant yields in dry seasons, but heavier yields are obtained in seasons of good rainfall on the heavy soil types. The farmers recognize the fact that the heavier types, especially the clay loams, are more suitable for wheat, oats, and other small grains than are the sandy soils. They also recognize fully that the Spur fine sandy loam, Spur loam, and Spur clay loam are the best soils for alfalfa and corn, with the flat dark-colored upland soils following next in order. The suitability of the lighter sandy soils for fruits, vegetables, and peanuts also is generally understood.

In preparing the land for crops, as well as in subsequent cultivation, the main consideration is to increase the capacity of the soil for collecting and holding moisture. This emphasizes the necessity of frequent cultivation to keep the land free of grass and weeds and prevent unnecessary loss of water from the soil. The heavy soils are plowed, usually listed, in the fall, if practicable, or in winter, in order to catch and hold all precipitation possible, whether in the form of rain or snow. The lighter sandy soils, on the other hand, are generally left untouched until just before time for planting, in order to prevent drifting. While plowing is done in the winter where possible, some land is not plowed until spring. Sometimes the land is listed once, or it may be relisted just before planting. Seeds are planted in the water furrow, and subsequent tillage throws the soil from the bed into the furrow around the young plants. This places the roots of the plants some distance below the surface and makes the plants better able to withstand dry conditions.

The grain sorghums customarily are harvested by heading the grain, the stalks being left to be pastured off by stock. The grain is stored in barns or in open pens until fed to the stock. It is usually left in the head, though some is threshed. Part of the crop is cut and bound in bundles with the grain left on, and the bundles are fed to stock later as desired. Sorgo is cut as fodder or hay and stacked for use as needed. Cotton is picked as it matures and hauled at once to gins. Wheat is threshed from the stack or from the header and hauled to market within a short time afterwards.

The farm homes and other buildings are small; as many of the farm products are sold as soon as harvested, large barns are not generally needed. Most farms are well equipped with plows, cultivators, harrows, and planters, and on a number of the larger farms tractors are used for plowing.

No systematic plan of crop rotation is in general use, although crops are changed from time to time. No commercial fertilizer is used and very little barnyard manure. Few of the farmers take any steps to maintain the productiveness of the soils. This is to be expected in a new country in which the soils are generally quite productive. The Texas Agricultural Experiment Substation No. 7 at Spur has demonstrated that one of the best means of improving the soils of the region is green manuring. It has been shown that sorgo, grain sorghum, or other green crops can be plowed under with excellent results. Plate X, figure 2, shows a crop of grain sorghum in the process of being turned under for green manure.

The local farm-labor supply is usually sufficient through the period of the year when the crops are being grown. The laborers are largely white, though some Mexicans and negroes are employed. During the harvesting of wheat and grain sorghums and cotton picking some labor is brought into the county. Farm labor is paid about $25 to $30 a month with board or $35 to $40 a month with quarters. Harvest hands are paid $3 to $4 a day with board, while cotton pickers receive from $1 to $1.50 per hundred pounds of seed cotton.

The farms of the county vary widely in size. There are a few of less than 160 acres, which is about the standard small farm. A

number of farms contain several hundred to more than a thousand acres, but these are customarily leased in smaller tracts. The large cattle ranches wholly or partly in the county comprise individual holdings of 100,000 acres or more. A number of smaller cattle ranches range in size from 5,000 to 10,000 acres.

According to the census of 1920, 59 per cent of the farms were operated by owners, 40.7 per cent by tenants, and 0.3 per cent by managers. Farms ordinarily are leased on shares, the owner receiving one-third of the grain and one-fourth of the cotton for the use of the land and farm buildings.

Not much land has been sold within the last year or two in Dickens County, either by small landowners or by the large land and cattle companies that hold the bulk of the unimproved land. Unimproved land of the better grade is held around $20 to $30 an acre. Improved farm land sells for $30 to $50 an acre, well-improved farms near towns and good roads bringing $75 to $100.

SOILS

Dickens County lies in the central part of the plains region of the State, and the soils therefore have been formed under conditions of a light rainfall. The materials from which the different soils have been developed are unconsolidated or rather slightly consolidated clays, silts, and sands all more or less calcareous, ranging in age from Upper Paleozoic (Permian) in the eastern part of the county to Tertiary or later in the northwestern part.[1]

Narrow areas of alluvial soils occur along the larger streams of the county, constituting a considerable total area of rich agricultural lands. This material has been washed from the High Plains, the secondary plateau region, and the area underlain by Red Beds.

Wind action has played some part in the accumulation of materials forming some of the soils. Small areas of sands have drifted into dunelike areas in the northeastern and southwestern parts of the county.

The soils range in color from gray through red and brown to nearly black. In texture they vary from fine sands to clays. Most of the soils have a layer of soft marly material, composed mainly of lime carbonate a few feet below the surface; in normal position about 5 feet down, in some places not over 12 to 18 inches, and occasionally exposed on eroded slopes. Above this layer the material of the uplands is noncalcareous, at least to the extent of not effervescing with hydrochloric acid. The young or recently deposited alluvial soils are nearly everywhere calcareous from the surface down. The subsurface layer of the upland soils is usually darker and heavier than the surface layer. The lower subsoil, below about 12 to 20 inches, is generally lighter in color than either the surface or subsurface layer.

With few exceptions the soils generally have good penetrability, allowing ready passage of soil water through the mass, while the subsoils are retentive of moisture. No hardpan or other impervious

[1] The authority for this statement is the "Review of the Geology of Texas," Bul. 44, University of Texas, by J. A. Udden, C. L. Baker, and Emil Bose.

layers appear. The virgin soils are for the most part fairly well stored with organic matter.

From the soil materials of Dickens County have been developed a number of distinct types, differing in one or more of the following characteristics: Color, texture, structure, character of the parent material, and process of accumulation. These types, which are described in detail in another part of this report, may be grouped broadly into (1) sandy soils always loose, (2) sandy lands always more or less compact, (3) heavy soils usually compact, and (4) rough broken lands.

The loose sandy soils do not occupy a very large area, but they comprise some areas of local importance in the northeastern and southwestern parts of the county. They are gray in color on the surface and are underlain by red clay subsoils at depths varying from 2 to 6 or 8 feet. These soils are noncalcareous and loose, although on drying the sand assumes a slightly hardened condition at the immediate surface. These sandy soils drift badly and in places have dunelike topography. A characteristic growth of small shin oak has given rise to the local name "shinnery sand."

The compact sandy soils occur over a very large part of the county, the largest areas being in the northern part. The soils are brown to reddish in color and the subsoils consist of heavy red clay, which in places is calcareous in the lower part of the 3-foot section. Beneath the 3-foot depth there are in places beds of gravel, and above this a zone of lime-carbonate accumulation. The surface soils of uncultivated areas become hard when dry and break up into coarse clods or fragments when plowed. Where cultivated the soil is friable and loose to a depth of about 2 to 4 inches. The upper subsoil is hard when dry and difficult to break, forming clods of considerable size. The lower subsoil, though hard when dry, breaks into a fine cloddy or a granular condition.

The compact heavy soils consist almost entirely of brown or chocolate-brown to red or purplish-red clay loams. In depressions and on some flat areas black and nearly black soils are found; but wherever the surface is rolling the characteristic reddish color is developed. These soils are extensive in the southern or Red Beds region and occupy the High Plains part of the county. A layer of lime carbonate accumulation is reached several feet below the surface. In the rolling areas of the Red Beds region the layer, though present, is not so rich in lime. When dry the uncultivated soils harden, but upon plowing readily break down into fine clods or fragments easily pulverized. In cultivated fields these soils are granular to mellow. The upper subsoil consists of a heavy refractory clay. The lower subsoil is somewhat calcareous and is lighter colored than the upper subsoil, and although hard when dry the material breaks into a fine fragmental or granular condition.

The rough broken lands occur principally in the southeastern part of the county, with some large areas along the escarpment of the High Plains in the northwestern part and along some areas in the central sections. These are formed by erosion, and the soil material varies according to the exposed geological formations. They are practically nonagricultural.

FIG. 1.—COWPEAS AND SWEET SORGHUM ON THE MILES CLAY LOAM

FIG. 2.—SUDAN GRASS IN DICKENS COUNTY

FIG. 1.—HOGS GRAZING ON ALFALFA ON THE SPUR CLAY LOAM

Miles fine sandy loam in the background at right

FIG. 2.—TURNING UNDER GRAIN SORGHUM AS GREEN MANURE ON THE MILES CLAY LOAM

The creek-bottom or alluvial soils occur principally in the central part of the county and range from light sandy soils to heavy soils. These soils are characteristically chocolate-brown to brownish-red in color, and they are almost invariably calcareous. When dry uncultivated areas harden slightly, even in the sandy members, but under cultivation a loose, mellow condition prevails.

The various soils of the county have been grouped into soil series on the basis of similarity in origin, color, and structure. The series consist of soil types that differ from each other in texture or the relative proportions of coarse and fine soil particles.

The Vernon series comprises those purplish chocolate red soils of the lower plains region which have been derived from the Red Beds. This formation includes purplish-red clay, claystone, and fine-grained sandstone, with some gypsum beds and yellowish sandstone. The surface soils are purplish red to dark reddish brown, and the subsoil purplish red in color. The soils and subsoil are more or less calcareous. The types mapped are the loam, clay loam, fine sandy loam, and very fine sandy loam.

The Cottonwood series includes types with very dark brown soils resting on a light-colored subsoil high in gypsum. Only one type, the loam, is mapped.

The types of the Miles series are reddish brown to dark brownish red in the surface and purplish red in the subsoil. The soil, subsurface, and upper subsoil material usually does not effervesce with hydrochloric acid. Below 3 feet the material is calcareous and at about 3 to 5 feet beds of caliche occur, as well as some gravel in places, which is more or less cemented. This layer of lime accumulations occurs at less than 3 feet in some eroded areas. These soils are derived largely from outwash materials, that is, materials which have been washed down from higher areas and distributed over relatively smooth country. This process is in active operation along the scarps in many places at the present time. The Miles soils have a more purplish red color than the Amarillo. These soils cover a large part of the county. The fine sandy loam, gravelly fine sandy loam, clay loam, and fine sand are mapped.

The Abilene soils are chocolate brown, and very dark at the surface, which often appears nearly black when wet. The subsoils are dark chocolate brown or very dark brown to nearly black in the upper part and chocolate brown and calcareous in the lower part. These soils are underlain by a layer of lime carbonate accumulation and in places gravel conglomerate beds. They are closely associated with the Miles soils, but generally occupy more nearly level positions. They have been derived from the same kind of material as that giving the Miles soils, and they have developed in much the same way, the darker color being attributable to less perfect drainage conditions. The soil, subsurface, and upper subsoil section are usually not sufficiently high in carbonate of lime to effervesce with hydrochloric acid. The Abilene soils differ from the Richfield soils in having a chocolate-brown color. The Abilene loam, fine sandy loam, clay loam, and silty clay loam are mapped.

The Amarillo series includes types with reddish-brown to dark reddish brown surface soils, subsurface or upper subsoil layers that are brownish red to reddish brown and a lower subsoil of salmon-colored to pink material high in lime carbonate. The layers above seldom effervesce. A bed of lime carbonate material lies about 5 feet below the surface. The soils are derived from the materials covering the High Plains. They closely resemble the Miles types, but apparently contain less material from the Red Beds and characteristically have the chocolate shade less strongly developed. Only the silty clay loam is mapped.

The types included in the Richfield series have very dark brown to nearly black surface soils, a nearly black upper subsoil, and a chocolate-brown calcareous lower subsoil. These soils are closely associated with the Amarillo, but have poorer drainage and doubtless owe their difference in color to the accumulation of organic matter under poorer drainage than that which has prevailed over areas occupied by the Amarillo. The silty clay loam and a shallow phase of the gravelly loam are mapped.

The types in the Randall series are very nearly black to ashy gray or very dark bluish gray in the surface soils, and have an ashy to bluish-gray subsoil. The subsoil is generally in a moist condition. Only the clay is mapped.

The Spur series includes recent-alluvial soils consisting of materials washed from the upland soils. They characteristically are chocolate brown in color in both the surface soil and subsoil, and are uniformly calcareous from the surface down. There is more of a chocolate cast in the Spur soils than in the Frio, which also are important first-bottom soils of western Texas. The Spur loam, loamy fine sand, fine sandy loam, and clay loam are mapped in the present survey.

The Derby soils typically are reddish brown, with red subsoils. They consist of material recently blown from stream beds of the plains region and deposited as marginal strips along the adjacent highlands. The Derby fine sand mapped in this area is much too light in color for the Derby series. It has been included in that series owing to its genetic relation and unimportant extent.

The Miller soils are the purplish-red soils with purplish-red subsoils occurring in the first bottoms of the regional streams. These are of alluvial origin, having been formed by the deposition of sediments washed from the uplands of the region where there is enough of the red soil to give sufficient material to dominate the color. These soils are of extremely small extent in the county. The very fine sandy loam and clay loam were mapped.

Rough broken and stony land includes eroded, broken, and gullied or stony areas of soil, regardless of texture, where no land is arable.

The soil types are described in detail in subsequent pages of this report. Their distribution is shown on the accompanying soil map. The table following gives the actual and relative extent of the soils mapped:

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Miles fine sandy loam	12,928		Spur fine sandy loam	10,432	1.8
Rolling phase	136,320	26.4	Spur clay loam	7,168	1.3
Depression phase	2,304		Vernon fine sandy loam	7,168	1.3
Rough broken and stony land	99,840	17.5	Miller very fine sandy loam	3,968	.7
Vernon very fine sandy loam	37,376		Randall clay	3,840	.7
Broken phase	17,536	9.6	Miles gravelly fine sandy loam	3,584	.6
Miles clay loam	52,992	9.3	Abilene silty clay loam	3,136	.5
Miles fine sand	13,568		Spur loamy fine sand	2,752	.5
Shallow phase	34,752	8.5	Cottonwood loam	1,728	.3
Vernon clay loam	31,040		Miller clay loam	1,472	.3
Broken phase	6,592	6.6	Richfield gravelly loam, shallow phase	1,472	.3
Abilene fine sandy loam	10,496		Spur loam	704	.1
Shallow phase	7,360	3.1	Abilene loam	512	.1
Abilene clay loam	15,104		Riverwash	448	.1
Shallow phase	1,920	2.9	Derby fine sand	256	.1
Richfield silty clay loam	16,832	2.9			
Amarillo silty clay loam	14,784	2.6	Total	571,520	
Vernon loam	11,136	1.9			

VERNON FINE SANDY LOAM

The Vernon fine sandy loam consists of dark reddish brown or dark brownish red fine sandy loam, usually noncalcareous, underlain at about 6 inches by dark reddish brown, noncalcareous clay loam, which at about 15 inches passes into purplish-red calcareous fine sandy clay, containing numerous lime accretions and in places small rounded quartz gravel. The purplish-red color strengthens with depth and at about 36 inches assumes the true Red Beds color, that is, Indian red. The soil is not compact, although hard when dry, and the subsurface and subsoil layers have a fine fragmental structure. In places the Red Beds material, consisting of fine sandy loam or very fine sandy loam, with gray shaly gypsum, is found just below the surface soil or at some depth in the 3-foot section. The surface soil in uncultivated fields bakes rather hard in dry weather, but works up into a very loose and friable structure with cultivation.

The Vernon fine sandy loam is not extensive in Dickens County. It occupies several small areas in the eastern part, the largest being just west of Wichita School.

The surface is gently rolling to undulating and in some places is nearly level. The drainage is good, water penetrates the soil readily, and a good store of moisture is held in the subsoil. The soil is not as susceptible to erosion as the very fine sandy loam, though it will erode badly on the steeper slopes.

Only a small proportion of the Vernon fine sandy loam is used for farming—probably not over 50 per cent. It supports a scattering growth of mesquite trees, chaparral, and cat's-claw bushes, some wormwood, or "sagebrush," and a heavy growth of native grasses, consisting of buffalo grass (*Bulbilis dactyloides*), needle or poverty grass, some broom sedge, or little bluestem (*Andropogon scoparius*), and some of the grama grasses (*Bouteloua* sp.). It is used as pasture land in ranches.

Where cultivated the crops grown are cotton, grain sorghums, and sorgo principally. The yields in good seasons are about one-fourth to three-fourths bale of cotton and 25 to 40 bushels of grain sorghum per acre.

As the soil drifts badly in cultivated fields during the high spring winds, it is usually not plowed until spring. It is then left as thrown up by listers to prevent as far as possible the movement of the soil. It withstands droughty conditions quite well and is well suited to the production of vegetables, berries, and other small fruits, peaches, and plums.

VERNON VERY FINE SANDY LOAM

The Vernon very fine sandy loam ordinarily has only two layers in the 3-foot section. The surface soil consists of a purplish-red loamy very fine sand or very fine sandy loam. This grades at about 12 inches into a subsoil of lighter purplish red very fine sandy loam, which continues to a depth of 3 feet or more. The lower layer often extends to depths of many feet, with little change. In some places the subsoil is a loam or clay loam. Both surface soil and subsoil are strongly calcareous, and in many places thin layers of gypsum occur, usually at depths below 3 feet. Locally some accumulated lime is seen in the form of accretions in the subsoil, these increasing with depth in places. The zone where lime accumulation is greatest is 3 to 4 feet below the surface. Although rather hard when dry, the soil and subsoil are more or less friable. In many places there is very little change in color and texture in passing from the soil into the Red Beds material, from which the soil is derived, as here the Red Beds consist mostly of silt and very fine sand many feet deep, with occasional layers of gypsum. The surface soil appears to be rather low in organic matter.

The Vernon very fine sandy loam is a rather extensive soil type in the eastern part of the county. It occupies a very large and more or less continuous area just east and south of Wichita School.

The surface of the type is gently rolling to very rolling and hilly. Surface and internal drainage are good. Water penetrates the soil mass easily, and there are many streams through the type, with numerous tributaries consisting of small draws and canyons. These are deep and narrow, with blufflike slopes. When a slope begins to erode, a deep, narrow, vertical-walled gully is formed, which rapidly enlarges and eats back into the higher areas.

The Vernon very fine sandy loam is valuable, productive soil, but on account of the ease with which it washes it can be quickly injured by erosion. Very little of it is in cultivation in this county—possibly not 1 per cent. Most of it is utilized for grazing, and it constitutes a considerable part of the Pitchfork and other ranches. Inclusion in ranches has prevented its sale as farm land.

The soil supports a heavy growth of the native grasses, consisting mainly of the needle grasses (*Aristida nealyi*, *A. purpurea*, *A. reverchoni*), buffalo grass (*Bulbilis dactyloides*), and grama grasses (*Bouteloua gracilis* and *B. hirsuta*). Some broom sedge (*Andropogon scoparius*) also grows on this soil. A scattering growth of small mesquite trees (*Prosopis juliflora*), chaparral (*Zizyphus obtusifolia*), and cat's-claw (*Acacia tortuosa* and *A. constricta*) occur on the type. In places where the sand content is rather high there is also considerable sagebrush (*Artemisia filifolia*).

The main crops are cotton, grain sorghums, and sorgo. With good seasons these yield well—about the same or perhaps a little less than on the Vernon clay loam. In dry seasons the crops do not suffer

as soon as on the clay loam, and if continued drought prevails, the type produces better than the clay loam. The soil is well suited to the production of vegetables and berries and other small fruits. Among the tree fruits peaches and plums are most successful.

The land is handled in about the same way as the Vernon clay loam. Great care should be exercised to prevent erosion. Terracing and contour plowing should be employed, and organic matter added by plowing under green crops, such as cowpeas. The present price of the land is about $30 to $40 an acre.

Vernon very fine sandy loam, broken phase.—Large areas of the Vernon very fine sandy loam are so eroded and gullied that it is not suitable for agriculture. There are many small areas, constituting altogether probably 50 per cent at least of the total area, that are good smooth land, but the individual bodies are too small to be utilized for farming. On the other hand, the surface is not nearly so rough as that of the Rough broken and stony land. About one-fourth to one-half of these areas, however, do consist of rough broken land in the form of gullies and canyons. Therefore, the term broken phase is used to indicate areas where the Vernon very fine sandy loam and the rough broken and stony land are so intricately mixed as to prevent separation on the map.

This land occurs in rather large areas in the eastern and southeastern parts of the county, in the vicinity of the Pitchfork Ranch and Newmans Ranch.

There are three rough classes of this land: (1) Smoothly rolling large areas cut by numerous short dry stream beds with many tributaries, small canyons or gullies making up 25 to 50 per cent of the surface; (2) the very steep, hilly areas, which, while not rough, are too steep for cultivation except in mere patches; and (3) the narrow divides between the canyons occurring through the areas of Rough broken and stony land. The last has a generally smooth surface, but is badly eroded, and includes small hillocks and slopes bare of vegetation except for stunted cedars and small patches of broom grass, sedge grass, grama grass, a few mesquite trees, and cat's-claw. On these divides there is considerable outcropping of gypsum beds and many small plateaus occur, covering in places as much as several acres, that have a surface consisting mainly of a bed of soft gypsum 1 or 2 feet thick.

Although the broken phase of the Vernon very fine sandy loam is not suitable for cultivation, it is very good for cattle ranching, and is utilized for that purpose. The many eroded and gullied areas offer protection to cattle in winter and the grasses supply good pasturage. The water, while containing some gypsum, is good for stock and is obtained in sufficient quantities from wells by pumping with windmills.

VERNON LOAM

The Vernon loam consists of about 8 to 12 inches of purplish-red, mellow loam, underlain by purplish-red or light purplish red loam, clay loam, or clay, extending to depths of 36 inches or more and containing some hard lime accretions. Usually both soil and subsoil are calcareous. Although baking rather hard when dry, the soil breaks down into fine granules. In places there is a relatively large percentage of very fine sand in the soil and subsoil. Locally the

lower subsoil consists of the unweathered Red Beds material—that is, red shaly clay and gray to white gypsum layers. In many places this material lies below 3 feet deep, but in a few places it is almost at the surface.

The Vernon loam occurs in several small areas in the eastern and southeastern parts of the county. The largest of these lies just north of Newmans Ranch.

The type is gently undulating to gently rolling. It has good drainage and is susceptible to erosion. Some areas occupy high ridges in the Vernon very fine sandy loam and are bordered by rather rough eroded lands in places. The soil absorbs water easily and has good underdrainage. When very dry and hard the gently sloping surface allows rain water to run off easily, so that more precipitation is required to wet the land thoroughly than in case of the lighter textured types.

This is not an important farming soil at present, as much of it is included in large ranches. It has a few mesquite trees and some chaparral and cat's-claw bushes. It supports a heavy growth of grass, consisting principally of needle or poverty grasses, buffalo grass, and grama grass. These are valuable for grazing and constitute excellent pasturage for the cattle of the ranches.

Probably less than 10 per cent of the land is in farms, and these lie about 10 miles east of Spur along the edge of the Rough broken and stony land. The leading crops are cotton, grain sorghums, and sorgo. The yields are about the same as on the Vernon clay loam. The land in farms sold at the time of the survey (1922) for about $20 to $40 an acre.

Where a good supply of organic matter is maintained in the soil the yields are good. The land washes very easily and should be handled very carefully to prevent erosion. Terraces should be built and plowing and cultivation should follow the contours of the slopes. Any method that enables the land to catch and hold rain water, thus reducing the run-off, tends to lessen erosion.

VERNON CLAY LOAM

The Vernon clay loam consists of a purplish-red to dark purplish red clay loam, 4 to 6 inches deep, underlain by clay of similar color. At depths ranging from about 10 to 18 inches this passes into light purplish red clay, which usually extends to depths of 3 feet or more without important change. This clay rests on the parent Red Beds material, which lies at irregular depths. In places on the crests of ridges and on slopes it may appear within a few inches of the surface or outcrop. The surface soil becomes quite hard when dry, but when plowed breaks into a mass of small fragments or clods which pulverize easily and disintegrate when rained upon.

The Red Beds material giving this soil ordinarily consists of a purplish-red clay or clay shale, though in places the latter carries more sand and silt than clay. Throughout the deposits also there are thin layers of gypsum, with some calcium carbonate. The surface soil and the subsurface clay layer are usually calcareous, and in some places they contain lime accretions.

The light purplish red clay, which normally lies at 14 to 16 inches, just over the unweathered Red Beds, always carries considerable

lime carbonate in finely divided form as well as in the form of numerous rather hard accretions. On slopes or the crests of slopes there are places where the two upper layers are entirely absent and the calcareous layer is exposed, or the upper layers may be very thin and the lime layer only a few inches below the surface. There has been, however, no such accumulation of lime in the subsoil as in the Miles or Abilene soils; in fact, in many places there appears to be no accumulated lime at all.

In some places the upper layer consists of an inch or two of very fine sandy loam, and in other places a few quartz and sandstone gravel are scattered over the surface.

The Vernon clay loam is not a very extensive type; with its broken phase it covers some 37,000 acres. It occurs in a number of small and moderate-sized areas in the southwestern part of the county, within a few miles of Spur and near Dickens and Croton School, but is not confined to this part of the county. The surface is generally undulating to rolling. In most places the slopes are gentle.

Surface drainage is good, and water passes readily downward through the soil mass. The sloping surfaces favor the run-off; it requires more rainfall to insure a good supply of soil water on this soil than on the flatter types. During heavy rains surfaces not protected by some vegetation are subject to severe erosion.

The Vernon clay loam is a rather important soil type in the southern part of the county. Probably not over 20 per cent of it is in cultivation, as the country is thinly settled. A considerable part is in ranches and used for grazing. It is a productive soil with favorable moisture conditions, but does not withstand drought so well as some of the more sandy soils or the more level soils of heavy texture. A good growth of grass covers the land and a scattering growth of small mesquite trees and chaparral bushes is common. The native grasses consist mainly of buffalo grass[2] (*Bulbilis dactyloides*), needle grasses (*Aristida nealyi*, *A. purpurea*, and *A. wrightii*), with some mesquite grass (*Hilaria jamesii*), and grama grasses (*Bouteloua gracilis*, *B. hirsuta*). All these grasses are splendid for grazing, the buffalo and grama grasses being the most valuable.

The principal crops are cotton and the grain sorghums. Milo is grown more generally than the other grain sorghums. Small acreages of sorgo are grown for forage. Small acreages are in oats and wheat. Crop yields depend largely on the rainfall. Ordinarily cotton yields one-third to one-half bale per acre. Grain sorghums ordinarily return 25 to 40 bushels per acre, though in some seasons the yield reaches 50 or 60 bushels. In seasons of good rainfall oats yield 30 to 50 bushels per acre, and wheat 15 to 25 bushels. In dry seasons these crops yield much less and sometimes nothing.

The soil is somewhat more difficult to plow than the sandy soils, but works down under cultivation into a friable, mellow seed bed. It does not drift as much as the sandy soils in the heavy spring winds.

Many farmers plow the land in the fall, leaving it rough to hold as much rain or snow as possible. The common practice is to use a

[2] Locally the mesquite grass (*Hilaria jamesii*) is called buffalo grass, and the buffalo grass (*Bulbilis dactyloides*) is called mesquite grass. In mentioning these two grasses in this report the botanical classifications and not the local applications are used.

lister throwing the soil onto beds. Before planting the land is relisted; that is, the beds are split open and the soil turned back over the previous deep furrow. The seed of "row crops" is planted in the water furrow, and after the plants are several inches high the soil from the ridges is turned toward the plants, the final cultivation leaving the surface nearly level and the plant roots deeply seated. This seems to be the best practice where dry conditions are likely to prevail. No fertilizers are used and no steps taken to maintain the productiveness of the soil. This being new, deterioration is not yet apparent.

Unimproved land of this type at this time (1922) sells in small tracts for $25 to $35 an acre and improved farms for $30 to $60 an acre, depending on location, improvements, and distance from the railroad.

Although this is naturally a rather strong soil, care must be used to prevent the depletion of organic matter if the productiveness is to be maintained. The land should be cultivated in such a way as to control erosion as far as possible. It would probably be profitable to terrace the more rolling fields.

Vernon clay loam, broken phase.—The Vernon clay loam, broken phase, comprises areas of Vernon clay loam that have been dissected rather completely by gullies and the heads of short streams. It occupies several thousand acres in the southwestern part of the county, just east of West End School, where a number of streams cut through the areas of Vernon clay loam and have numerous small tributaries which ramify all parts of the land. These small stream ways and the associated gullies have so cut the surface that there are no areas large enough for farms. The Red Beds formation has been exposed in many places.

This phase supports a growth of the native grasses, like those on the typical soil, and affords good grazing. The land is utilized for cattle ranching.

COTTONWOOD LOAM

The Cottonwood loam is a dark-brown or chocolate-brown silty loam, underlain at 4 to 12 inches by beds of gypsum, with which is associated some lime carbonate. In places the soil is rather heavy and below 3 or 4 inches is a silty clay loam. The material of the soil and underlying beds effervesce strongly with hydrochloric acid. On slopes and in some flat areas the gypsum is exposed at the surface; in several deep cuts it is shown to be deeper than 6 or 8 feet. These exposed beds in places occupy several acres.

The Cottonwood loam has a total area of approximately 3 square miles. It occupies small areas associated with the Abilene silty clay loam. A small area lies east of Dickens and others lie not far from Red Hill School in the southeastern part of the county.

The type occupies flat or depressed areas and the drainage is naturally rather poor except along the small draws.

None of the Cottonwood loam is under cultivation. It is evidently a rather thin soil. It is used with the more extensive types for grazing. The type supports a scattered growth of mesquite trees and a rather thick stand of short bunch grass and affords fairly good grazing.

MILES FINE SAND

The surface soil of the Miles fine sand is a brownish-gray to grayish-brown, loose fine sand, 2 to 6 inches deep, slightly darkened in places by a scant accumulation of organic matter. The subsoil consists of pale yellowish red fine sand, ordinarily at least 36 inches deep and 6 or 8 feet deep in places. The fine sand is slightly hard when dry. Locally it has only a faint reddish cast even in the deep subsoil, although many included areas are yellow in the subsoil and therefore are not typical of the Miles series. The subsoil rests upon a heavy red clay at depths of 36 inches or more. In places the transition from fine sand into the red clay is through a layer of a few inches of light purplish red or salmon-colored loamy fine sand.

As mapped in Dickens County, the type includes small areas where the clay comes within less than 3 feet but rarely within 2 feet of the surface. The larger of these have been mapped as the shallow phase of the Miles fine sand. When thoroughly dry the clay substratum becomes extremely hard. The material does not effervesce with hydrochloric acid in the soil section or the clay substratum. At depths of about 5 to 8 feet whitish lime material was seen in a few exposures. It may be that much of the soil has lime in the deep substratum, but exposures were too scattered to supply much evidence bearing on this question.

The Miles fine sand has a total extent of about 21 square miles. It occurs in a narrow belt in the northeastern part of the county, several miles east of Afton, and in small areas in the extreme southwestern part.

The type occupies rather high ridgelike swells and elevations, surrounded by large areas of the shallow phase of Miles fine sand. There are many small circular hillocks only a few feet in elevation and less than one-half acre in size, mostly less than 100 feet across. In general the surface is rolling, with a somewhat ridgy or dunelike appearance. The surface drainage is good; the soil is so loose that much of the rainfall is quickly absorbed. The clay underneath the soil acts as a good reservoir for water, and even in dry seasons the grasses on this type attain a considerable height.

The Miles fine sand is used only for pasture. It supports a growth of the low-growing shin oak (*Quercus undulata*), the stand of which in many places is very thick. Bear grass, a species of yucca, is also a characteristic plant as also is sweet wormwood, or sagebrush (*Artemisia filifolia*). A heavy growth of rather coarse rank-growing grasses occurs over this type. One of the most important of these is broom sedge (*Andropogon scoparius*), and in places there is also a heavy growth of Indian grass (*Sorghastrum nutans*), sand dropseed (*Sporobolus cryptandrus*), and considerable of another coarse grass (*Eragrostis trichodes*). Small amounts of tall needle grass (*Aristida wrightii*) and hairy grama (*Bouteloua hirsuta*) also appear, and there may be a few other species. These grasses start growth early in the spring; they afford good grazing when young and afford some grazing the year round. Practically all this land is in pasture, the most of it in a large area extending from a point west of Deer Lake School northward to within 3 miles of the north county line.

In a few spots where vegetation is scant this soil drifts into dunes, and for this reason probably would not be a suitable soil for cultivation unless windbreaks were grown. Although it is a thin soil, it would doubtless produce fair yields of melons, some vegetables, berries, grapes, and plums. Cotton and grain sorghums could be produced, but this is not a strong soil and not especially suited for these crops.

Miles fine sand, shallow phase.—The shallow phase of the Miles fine sand differs from the typical soil chiefly in its shallower depth to the clay stratum. It consists of gray to grayish-brown fine sand, slightly darkened by organic matter, underlain at about 2 to 6 inches by pale-yellow fine sand which at depths of 18 to 36 inches overlies tough red clay slightly sandy in the upper part but heavier below and faintly mottled with gray and yellowish brown. The surface soil is loose, and the subsurface layer of fine sand is also loose when moderately moist, though slightly hard when dry. Neither the soil nor subsoil effervesce with hydrochloric acid.

In places the fine sand immediately over the clay is reddish yellow or light red in color and slightly loamy, and represents a zone of transition from the fine sand to the clay. There is considerable medium and some coarse sand in the soil and subsurface of some areas. The areas of this phase also include some very small dune-like mounds of the Miles fine sand supporting heavy clumps of shin oak of larger than average size. These areas are too small to show separately on the map.

This phase is a rather extensive soil in Dickens County. It occurs in large areas in the northeastern part, some 6 miles east of Afton, and in a good-sized area in the southwestern part, beginning about 1 mile west of Red Top School.

The phase occupies broad, gently rolling, ridgelike swells or drainage divides. A number of swales extending far into these areas serve as collection basins for water and are the heads of stream valleys. In places long depressions occur which have no definite outlet for drainage. This soil has good surface drainage generally, and the loose soil favors the quick absorption of rain water. The underlying clay makes a good storage reservoir for moisture.

The shallow phase of the Miles fine sand is utilized principally as grazing land. Probably not more than 5 per cent is in cultivation. The vegetation is practically the same as on the typical soil. The finer grasses, such as needle and grama, are apparently slightly more abundant, and there is less of yucca and sagebrush, and the growth of shin oak is thinner and smaller. The pasturage is therefore somewhat better on the phase than on the typical soil.

The crops grown on land of this phase consist chiefly of milo and sorgo, with an occasional field of cotton or peanuts, the latter very successfully. Milo ordinarily yields 20 to 30 bushels per acre, sorgo 3 to 4 tons, and cotton one-fourth to one-third bale.

While this is not a strong soil, it seems that crops withstand dry weather well, doubtless because of the good store of moisture in the heavy clay subsoil. The soil, however, drifts badly in heavy winds, and for best results a system of windbreaks should be grown.

When farmed without windbreaks it should be handled carefully to prevent drifting. The soil is deficient in organic matter, and a supply of this should be maintained in the soil. Cowpeas would be

very beneficial to the soil, especially if plowed under. Barnyard manure would be a good fertilizer for this soil, as would also various nitrogenous fertilizers, such as cottonseed meal.

This land is generally left rough and with vegetation on it and is not plowed until just before planting time. This tends to keep the soil in place. The rows of intertilled crops are run at right angles to the general direction of the prevailing heavy winds. Sometimes a deep furrow is plowed around the land to catch the sand blowing along the surface and sometimes deep furrows are plowed through the field at intervals for the same purpose. Occasionally the young plants of crops are destroyed by drifting sand and replanting is necessary.

The soil is well suited to vegetables and other crops liking an open-textured soil. It would seem that windbreaks might be grown of the fast-growing salt cedar and much of the land utilized successfully for farming.

Most of this land is in large ranches and not for sale. Some small tracts have been sold for $15 to $25 an acre.

MILES GRAVELLY FINE SANDY LOAM

The surface soil of the Miles gravelly fine sandy loam is a purplish-red or reddish-brown fine sandy loam, carrying a very large proportion of small, smoothly worn chert, quartz, and other gravel fragments of irregular shape. At about 6 or 8 inches the surface soil is underlain by a bed of fine gravel, with only a small percentage of interstitial material consisting of fine sand and clay. The gravel fragments are brown, red, white, and black in color and the beds are several feet deep. The gravel in places has been slightly cemented into "concrete," and in other places thoroughly cemented into a hard conglomerate rock. The cementing material is chiefly lime. There are also large fragments of sandstone, some of a calcareous nature, in the gravel beds. In spots the subsoil consists of a whitish to pinkish chalky material.

The Miles gravelly fine sandy loam occurs in a number of small areas in the western part of the county and in two areas near the eastern boundary north of Dripping Springs. It lies on low and high ridges and forms the crests of smoothly sloping hills, the slopes of which are occupied by the Miles fine sandy loam. The surface drainage is good and the subdrainage rapid.

The type is utilized only as pasture land. There are a few mesquite trees and some chaparral. The typical bush growth is cat's-claw (*Acacia constricta* and *A. tortuosa*) which grows rather abundantly. There is considerable grass consisting largely of the short needle grasses (*Aristida purpurea*, *A. nealyi*, *A. reverchoni*) along with some tall needle grass (*A. wrightii*), and some grama grass (*Bouteloua gracilis* and *B. hirsuta*). Occasionally sagebrush, yucca, and some species of cacti appear on the type. In places there is broom sedge (*Andropogon scoparius*) and side-oat grama (*Bouteloua curtipendula*). The grasses afford good grazing, and the cat's-claw and some other plants are valuable honey plants.

No crops are grown on this type. The large gravel content makes it undesirable for farming. The gravel beds are a source of material for road building and other construction work.

MILES FINE SANDY LOAM

The Miles fine sandy loam is a dark reddish brown or dark brownish red, rather heavy fine sandy loam, about 8 to 14 inches deep, overlying dark purplish red to reddish-brown, rather heavy fine sandy clay, extending to an average depth of about 24 inches, where it passes into a bright purplish red fine sandy loam or fine sandy clay loam, extending to 36 inches and deeper. The soil and subsoil in places carry a little chert and quartz gravel. Both soil and subsoil are rather hard when very dry, even in fields that have been cultivated. The hardened surface is broken with difficulty. It seems to get even harder than in the heavier soils. The lower subsoil is not so hard as the soil and upper subsoil. The type throughout is usually noncalcareous, though in places the subsoil gives a very faint effervescence.

The type includes small areas in which the surface soil and subsoil are very dark, resembling the Abilene fine sandy loam. In these spots the soil is even harder when dry than where the red color prevails. At 3 to 5 feet there is commonly some lime accumulation, but as a rule the lime is in concretions and limy clay formation rather than true caliche, as this appears to be a comparatively young soil occupying rather recent terracelike areas.

The Miles fine sandy loam occurs in a number of small areas throughout the southwestern and central parts of the county. The surface is generally flat, but in places it is very gently sloping or undulating. The drainage is fairly good, though water stands in places until absorbed by the soil. The lack of surface drainage is usually a decided advantage in a region of light rainfall, as more water soaks into the soil and is stored for use of crops.

The Miles fine sandy loam is an important agricultural soil. Probably 75 per cent of it is in cultivation in Dickens County. The native vegetation is a scattering growth of mesquite trees, with some chaparral and cat's-claw bushes and a heavy growth of short grasses, mainly short needle grasses, grama grasses, and some buffalo grass. The Asby golden aster (*Chrysopsis villosa*) is a rather common weed.

The type is utilized for the general farm crops of the region, cotton, grain sorghum, and sorgo. The yields are usually good; even in dry seasons the soil is fairly drought resistant. Wheat and oats have been grown, but these crops do not yield as well as on some of the heavier soil types.

Cotton ordinarily yields from one-third to one-half bale per acre and considerably more in especially favorable seasons. Milo, the principal grain sorghum, yields 25 to 40 bushels or more per acre. Sorgo yields several tons of forage per acre. Wheat yields 10 to 15 bushels and oats 30 to 60 bushels per acre in normal seasons. Some corn has been grown. The yield is from 15 to 25 bushels per acre in years of average rainfall.

The soil is well suited to tree fruits, berries, and vegetables, and these are grown in small home orchards and gardens. Grapes do especially well and are of fine quality.

Land of this type is very much desired for farming and in well-improved farms is now held at about $40 to $75 an acre.

The soil is handled like the other sandy soils of the county. Although rather compact when dry, it drifts to some extent in heavy winds. A good supply of organic matter should be maintained in the soil, to keep up its natural productiveness. This will add nitrogenous constituents to the soil, increase its water-holding capacity, and aid in preventing drifting.

Miles fine sandy loam, rolling phase.—The Miles fine sandy loam, rolling phase, consists of reddish-brown fine sandy loam, underlain at about 3 to 6 or 8 inches by purplish-red clay. At depths of several feet, as revealed in cuts, there are beds of gravel consisting of quartz, quartzite, and sandstone, and below the gravel a thick bed of whitish limy material. Plate XI, figure 1, shows a typical exposure of this material. Both soil and subsoil are noncalcareous.

There are a number of important variations. One of these consists of a fine sandy loam or light-brown loamy fine sand, underlain at about 4 to 14 inches by dark purplish red heavy clay, grading at about 18 to 24 inches into bright purplish red sandy clay, which continues to 36 inches or more. In some places the surface soil is 10 to 14 inches deep and consists of two layers, an upper one of grayish-brown or brown loamy fine sand, and a lower one, below 6 or 8 inches, of brown or yellowish-brown fine sand or sometimes a reddish-brown fine sandy loam. This deeper surface soil does not bake as hard as the shallower soil. In many places along the slopes there is considerable rounded gravel on the surface and through the soil mass. The layer of limy material also outcrops in places on some of the steeper slopes. The large areas of the phase include some small bodies of Miles fine sand and the depression phase of the Miles fine sandy loam.

The Miles fine sandy loam, rolling phase, is an extensive and important soil. It occupies the greater part of the high secondary rolling plateau that covers much of the northern half of the county.

The surface is generally rolling, though some small areas are undulating. A number of good-sized stream ways head in areas of this soil or pass through it. These cut deep, narrow canyons at the margin of the plateau, where they go down into the lower plains, though in the interior of the plateau area the valleys are smooth walled and near the heads are broad swales. Drainage is good. Erosion is active and on some slopes is destructive. The soil absorbs water readily, however, and where the slopes are not steep the soil is drought resistant. The heavy clay subsoil is a good reservoir for soil water, and on the smoother areas crops on this soil withstand dry conditions remarkably well. Good drinking water is obtained in shallow wells on this soil.

Part of the land shown on the map as the rolling phase of the Miles fine sandy loam is a moderately rolling phase, of which it is estimated about 70 per cent is cultivable. This less broken phase ranges from gently rolling to rolling. Part of it occurs as rather steep hill slopes.

The rolling phase is an important farming soil. In certain sections, as north of Dickens through the north-central part of the county, probably 75 per cent of it is in cultivation, but in other places the proportion is less. Probably 50 per cent of its total area is farmed.

The vegetation on uncultivated areas is a heavy growth of shrubs, weeds, and grasses. The most prominent growth is the rather thick stand of small shin oak trees (*Quercus undulata*). Where the surface soil is heavy and shallow shin oak gives way to a scattering growth of mesquite trees, interspersed with short grasses, such as needle grass, grama grass, and a little buffalo grass.

Considerable quantities of sagebrush or wormwood (*Artemisia filifolia*), and in places of yucca or bear grass appear. One of the most prominent grasses is broom sedge (*Andropogon scoparius*), associated with some other species of Andropogon. Other coarse grasses abundant are Indian grass (*Sorghastrum nutans*), sand dropseed (*Sporobolus cryptandrus*), and *Eragrostis trichodes*.

The uncultivated areas of the soil are utilized for grazing. Large areas of the soil in the northeastern part of the county are included in ranches.

The leading crops are cotton, grain sorghum, corn, and sorgo. The average yields per acre in good seasons are about as follows: Cotton, one-third to one-half bale; milo, 20 to 40 bushels; corn, 20 to 30 bushels; and sorgo, 4 to 6 tons. On the less rolling land the yields of cotton, corn, and milo run a little larger. Peanuts are grown in some sections, yielding 15 to 25 bushels of nuts and 1 ton of hay per acre. Some vegetables, tree fruits, berries, and grapes are produced in home gardens and orchards. Watermelons and cantaloupes give good yields. They are grown in a small way for home use and for the local market.

The soil drifts badly where unprotected, and plowed land is left rough until time for planting. The steeper slopes should be terraced where they are to be used for cultivated crops to prevent loss of the top soil by erosion.

Land of this type at the present time (1922) sells for $25 to $60 an acre in improved farms; unimproved land is held at much lower figures.

The soil is naturally deficient in organic matter, which should be supplied by plowing under vegetation. Besides the ordinary benefits of such practice its use in preventing drifting and in increasing the moisture-holding capacity of this type should not be overlooked. The soil responds well to barnyard manure.

Miles fine sandy loam, depression phase.—The depression phase of the Miles fine sandy loam consists of brown or grayish-brown fine sand or loamy fine sand, grading at about 6 inches into a reddish-brown or brownish-red fine sand, loamy fine sand, or fine sandy loam, which rests at about 14 to 20 inches on a subsoil of dark purplish red clay or sandy clay. The soil and subsoil are noncalcareous. The surface is loose and the subsoil rather hard when dry.

This phase occupies only a few areas large enough to show on the map, though many small patches occur throughout the Miles fine sandy loam, rolling phase, and the Miles fine sand, shallow phase. The depression phase occurs mainly in the northern part of the county. One of the largest areas lies about 2 miles northeast of Wichita School in the eastern part of the county.

As its name implies, this phase is developed in depressions or swales. The surface is nearly flat and the run-off slow. Rain water escapes mainly by sinking into the soil, where it is held by the heavy subsoil. The slopes of the higher adjacent soils contribute

considerable run-off water to the depressed areas. Therefore, the crops on this phase do remarkably well in dry seasons.

The land is utilized on many farms, and probably half of it is in cultivation. Where not cultivated it supports a growth of small shin oak trees and a very heavy growth of sagebrush (*Artemisia filifolia*). The grasses are the coarse grasses found growing on the rolling phase of the Miles fine sandy loam. The crops grown are cotton, grain sorghums, corn, and sorgo. The yields are usually good, even in dry seasons. The surface soil is very loose and where unprotected drifts in heavy winds.

MILES CLAY LOAM

The Miles clay loam has three and sometimes four layers within the 3-foot section. The surface soil is a dark purplish red or dark reddish brown clay loam from 3 to 6 inches deep. The subsurface layer is a dark purplish red, rather heavy clay, which is sticky when wet and very hard when dry. The third or subsoil layer, beginning at depths of about 18 to 25 inches, is a purplish-red, calcareous clay, often containing small chert and quartz gravel. The lower subsoil is slightly lighter colored than the upper. It normally extends to depths of 30 to 36 inches and locally to 4 or 5 feet. It is underlain by pinkish-gray, soft, limy material that with depth tends toward white. In places the immediate surface soil is a sandy clay loam. The lower subsoil is commonly calcareous; the upper is not. The surface soil dries and bakes to a hard condition, but has what may be styled fragmental structure, the fragments being easily broken apart.

The color and gravel content of the subsoil of the Miles clay loam, together with its position, would seem to indicate that the parent material represents outwash from near-by areas of the Indian-red rocks of the region.

The Miles clay loam is an extensive soil type, occurring in a number of areas in the southern and central parts of the county. It has a flat to very gently sloping surface and fairly good drainage. The subsoil holds moisture well and is penetrable. Crops on this type resist dry weather conditions well, much better than on the Vernon clay loam.

The Miles clay loam is an important soil type, and probably more than half of it is in cultivation. Uncultivated areas support a heavy growth of grasses indigenous to the region. Some small mesquite trees grow on the type and a few scattering chaparral bushes. The grasses are mainly buffalo grass, mesquite grass, some grama grasses, and needle grasses. The vegetation is quite similar to that on the Vernon clay loam. Mesquite grass (*Hilaria jamesii*) and buffalo grass are very abundant. The needle grasses do not flourish as on the Vernon clay loam. Broomweed (*Gutierrezia sarothrae*) is abundant in places.

The crops grown are the usual general farm crops of the region—cotton, grain sorghums, and sorgo. Cotton yields one-third to one-half bale per acre on the average and milo 25 to 40 bushels per acre. Sorgo yields 4 to 6 tons of forage per acre. The yields vary greatly, according to the amount of rainfall. If this is light the yields may be somewhat lower, while if abundant the yields are much higher. Wheat and oats give good returns when the climatic conditions are

right. The same is true of corn, which is sometimes grown. The soil is handled in the same way as the other heavier types of the region.

Land of this type ranges in price from $25 to $60 an acre, depending on improvements and distance from towns.

The Miles clay loam is productive, and the productiveness can be maintained by keeping an adequate supply of organic matter in the soil.

ABILENE FINE SANDY LOAM

The Abilene fine sandy loam consists of chocolate-brown to dark chocolate brown, heavy fine sandy loam, underlain at depths ranging from 5 to 14 inches by dark chocolate brown clay loam or sandy clay loam to clay, which passes at depths of 18 to 24 inches into chocolate-brown to slightly reddish brown clay or clay loam containing considerable lime in the form of soft chalky particles. In some places the lower subsoil is yellowish brown. The content of lime increases rapidly with depth, and at about 3 to 5 feet predominates, the material here being a mixture of salmon-colored clay and soft whitish lime carbonate. In places the upper subsoil varies to the texture of a loam or even a fine sandy loam.

The surface soil and upper subsoil are not sufficiently calcareous, as a rule, to effervesce with acid. When dry the soil bakes rather hard and is difficult to plow, but breaks down into fine fragments when exposed to rains. The immediate surface dries out to a light chocolate brown color.

In some places where wells have been dug in this type a bed of gravel 10 feet thick is encountered some 30 feet below the surface. This is especially noted in the central part of the county in the vicinity of Soldier Mound Church.

The Abilene fine sandy loam occupies a number of small areas in various parts of the county. The largest are in the northern part in the vicinity of Prairie Chapel several miles south and east of Afton.

The surface is flat and in many places slightly depressed. Surface drainage is rather poor and underdrainage, on account of the heavy subsoil, is slow. However, in a region of light rainfall lack of drainage is rarely a drawback and is commonly an advantage. The subsoil holds a good supply of water for crops and it is said that crops on this type withstand periods of drought remarkably well.

Though not extensive, this is a valuable agricultural type, and probably half of it is in cultivation. In its natural condition it supports a rather heavy to light scattering growth of small mesquite trees, with some chaparral and cat's-claw bushes. There is also a good growth of grasses, consisting of buffalo, grama, and needle grasses, with some mesquite grass.

The main crops are cotton, grain sorghum, and sorgo. Some corn, wheat, and oats have been grown at times, but climatic conditions do not favor these crops every year, though in favorable seasons good yields have been obtained. The average yield of cotton is around one-half bale per acre, although in especially favorable seasons as much as 1 bale per acre has been harvested. Milo, the principal grain sorghum, yields 25 to 50 bushels per acre, producing a very full,

heavy grain. Sorgo, grown for forage principally, yields an average of 4 to 6 tons per acre. Alfalfa has been tried on this soil; it grows well when rainfall is sufficient but does not withstand long periods of dry weather.

The Abilene fine sandy loam, unimproved, ranges in price from about $20 to $30 an acre, and improved from $50 to $75, the latter price for farms in the best locations.

The soil is naturally productive and withstands droughts very well. Owing to its rather compact nature, the soil does not drift as much as some of the other sandy soils. It is locally called "black sandy land." Although it appears to be fairly well supplied with humus, it responds to the plowing under of organic matter.

Abilene fine sandy loam, shallow phase.—The surface soil of the shallow phase of the Abilene fine sandy loam is a grayish-brown to chocolate-brown loamy fine sand, 8 to 12 inches deep, overlying chocolate-brown sandy clay loam or sandy clay, which passes at 20 to 36 inches into salmon-colored to whitish chalky, calcareous clay. In places on slopes the subsoil from about 12 inches down to 6 or 8 feet consists of grayish-yellow or pale salmon colored chalky loam or clay. Where the surface is more nearly level this layer lies at a depth not less than 20 inches. On some slopes erosion has exposed this light-colored material in very small patches.

The Abilene fine sandy loam, shallow phase, is a soil of slight extent, occurring in a number of small areas. One of these lies just west of Red Top School in the southwestern part of the county. Others lie near Newhope School and Midway Church and elsewhere in the northern part of the county, and a few in the west-central part of the county.

The surface is gently undulating to rather steeply sloping. In the northern part of the county the phase occurs as steep slopes and knobs surrounded by areas of the Miles fine sandy loam, rolling phase. Here erosion is destructive and drainage excessive. In the more level areas the drainage is fairly good.

Smooth areas of this phase are well suited to farming, and approximately 75 per cent of it is in cultivation. Where uncultivated the soil supports a growth of shin oak, an occasional mesquite tree, some yucca or bear grass, sagebrush, horsemint weed, and several grasses, mainly broom-sedge grass, needle grass, and grama grass. The leading crops are cotton, grain sorghum, and sorgo, with some corn. On smooth areas yields are fairly good in seasons of adequate rainfall. Cotton yields one-fourth to one-half bale, corn 20 to 30 bushels, and milo 20 to 30 bushels per acre.

ABILENE LOAM

The Abilene loam is a chocolate-brown or dark chocolate brown clay loam, underlain at about 5 to 10 inches by chocolate-brown clay, which at about 16 to 20 inches passes into reddish-brown clay, extending to a depth of 36 inches or more, but having more of the Indian-red color below 30 inches.

The surface soil is nearly black when wet. On drying it assumes a hard condition in grass land, but breaks down to a good crumbly

structure in cultivated fields, so that it can be readily scooped up by the hand, even when it has not been plowed since the last rain. The layer below the soil also hardens, but it breaks down into large fragments when disturbed. In general the material above 16 inches does not effervesce with hydrochloric acid, but below this it is in many places calcareous, while from about 3 to 5 feet it is highly calcareous, consisting, in fact, of salmon-colored to whitish soft chalk.

The Abilene loam is very inextensive, occurring in only a few small areas near Soldier Mound Church, and in the south-central part of the county. The areas are flat and the surface drainage is very slow. This is an advantage, as it enables the soil to absorb all the rain water, which passes down into the lower clay subsoil and is held for the use of plants.

The Abilene loam is a good farming soil, but of slight importance because of its small extent. Probably 90 per cent of it is in cultivation. The native vegetation includes a few mesquite trees and chaparral bushes and a good growth of the short grasses, mainly buffalo, grama, and needle grasses.

The same crops are grown as on the Abilene clay loam and Miles clay loam, and the yields are approximately the same. Land of this type occurs in farms that sell for about $30 to $60 an acre.

ABILENE CLAY LOAM

The surface soil of the Abilene clay loam is a dark chocolate brown to very dark chocolate brown clay loam, about 8 to 10 inches deep. The upper subsoil is a very dark brown or dark chocolate brown clay, rather hard and tough. Below 16 to 20 inches a chocolate brown or reddish brown clay appears. This extends to depths of 36 inches or more. The lower subsoil is normally calcareous; the upper subsoil is not. Soft, salmon-colored, and whitish limy material is found in most places at depths of 4 or 5 feet. The soil is usually very dark colored and when wet is almost black. It is rather hard during dry weather, especially in grassed areas, but can be kept in a mellow condition by cultivation.

The Abilene clay loam is fairly extensive in Dickens County. It occurs in many small areas in the southwestern and central parts of the county.

The surface is flat and the drainage is therefore rather slow. In places the land lies somewhat lower than the surrounding soils and receives some run-off. The water sinks slowly downward and is stored in the heavy subsoil. Good water is often obtained in shallow wells on this soil.

This type, locally called "black land," is held in considerable favor by the farmers. Probably 50 per cent of it is in cultivation; the rest is pasture land. Virgin areas have a scattered growth of good-sized mesquite trees and chaparral bushes. The grasses consist mainly of the very valuable short grasses, chiefly buffalo grass, grama grass, with a small proportion of needle grass. Some mesquite grass also grows in places.

The main crops grown are cotton, grain sorghum, and sorgo. The soil is well suited to these crops, which produce good yields

except in an occasional poor season. The yields per acre are approximately as follows: Cotton, one-half to three-fourths bale; milo, 30 to 50 bushels; and sorgo, 5 or 6 tons of forage per acre. Corn yields well when there is sufficient rainfall. Wheat and oats may be produced to good advantage if the fall and spring rainfall is adequate. The soil is suited to alfalfa, which gives good yields in favorable seasons. The occasional dry seasons reduce the average decidedly. Broomcorn probably would do well. This land in improved farms sells for $30 to $40 an acre.

Abilene clay loam, shallow phase.—The shallow phase of the Abilene clay loam consists of light chocolate brown, calcareous, friable clay loam, containing an appreciable amount of fine sand, underlain at about 8 to 10 inches by brownish-yellow, yellowish-brown, or very light chocolate brown friable clay loam or clay, containing considerable soft, chalky lime. This increases until at about 20 to 36 inches a whitish to pale salmon colored bed of soft lime carbonate material is encountered. On drying the surface assumes a light-gray to nearly white appearance.

This phase occupies only a few areas in the county. The largest, containing about 2 square miles, lies in the west-central part of the county between Spur Ranch and Stafford Ranch. A very small area lies about three-fourths mile south of Soldier Mound Church, in the south-central part of the county, and another about 1 mile southwest of Spur. The phase has a gently sloping surface and good drainage.

The land is utilized along with other soils that constitute the main farm lands. Perhaps 60 per cent is in cultivation. The native growth includes small mesquite trees, chaparral, buffalo grass, grama grass, and some needle grass. The crops grown are cotton, milo, and sorgo. Cotton yields approximately one-third bale, milo 20 to 30 bushels, and sorgo 2 to 3 tons per acre. The soil seems to withstand droughty conditions quite well. This soil can be improved by incorporating large quantities of vegetable matter and by growing cowpeas.

ABILENE SILTY CLAY LOAM

The surface soil of the Abilene silty clay loam, locally known as "black land," is a very dark brown or dark chocolate brown to nearly black silty clay loam, 3 to 6 inches deep. The subsoil is a dark-brown to nearly black, rather silty clay, which when dry bakes into a hard mass and is broken up into small clods with difficulty. It is stiffer than the subsoils of the other heavy soil types. It is calcareous in many places, though in some areas lime carbonate is not noticeably present above depths of 18 or 24 inches. In places the subsoil below 18 inches is a grayish-brown to very dark grayish brown clay, with white lime or chalky specks.

When wet the soil is black; on drying the immediate surface has a dark ashy gray cast. The soil is sticky when wet and on drying bakes. Clods formed in plowing are broken down with moderate difficulty.

A peculiar feature of this type is the outcropping in many places of white gypsum beds, giving rise to spots of Cottonwood loam. In some places the soil is underlain at about 12 inches by dark reddish brown clay of a calcareous nature and of granular structure.

The Abilene silty clay loam occurs in a few small areas in Dickens County. The larger bodies are those about 6 miles east of Dickens. A few areas lie several miles northeast and east of Spur.

The type is characteristically flat. It occupies shallow basinlike areas, slightly lower than the surface of the surrounding soils. Therefore the natural surface drainage is very poor and water runs off either very slowly or remains until absorbed by the soil. In places small, shallow lake beds, consisting of Randall clay, lie within this type. These receive some drainage water from the adjacent slightly higher land. The subsoil holds considerable water, and the soil is fairly resistant to dry conditions, though not so resistant as the sandy soils. Many small draws or gullies, the heads of intermittent streams, head in areas of this type.

This is a rather productive soil, and is used for the important crops of the region. It is handled in about the same way as the Abilene clay loam. Plate XI, figure 2, shows a crop of feterita on the Abilene silty clay loam.

AMARILLO SILTY CLAY LOAM

The Amarillo silty clay loam is a dark reddish brown heavy silty clay loam, 4 to 8 inches deep, overlying dark reddish brown or dark brownish red, heavy clay, which passes at depths of about 20 to 28 inches into salmon-colored, calcareous clay. At depths of 3 feet or more it rests upon a pink or salmon-colored clay-chalk layer of caliche, which grades at about 5 feet into cream-colored, white, and pale salmon colored, soft, limy material. The soil and upper subsoil are not sufficiently high in lime carbonate to effervesce with hydrochloric acid.

The Amarillo silty clay loam occupies fairly large areas in the northwestern part of the county on the high plains. Westward from here it occurs in very large areas all the way to the New Mexico line. McAdoo, a village in the northwestern part of the county, is surrounded by the main areas of the type in Dickens County.

The surface is level to gently undulating. Some areas adjacent to lake beds are gently sloping to quite sloping for short distances. The run-off is slow and water stands over much of the land after rains. The soil is penetrable and the water escapes by passing into the subsoil.

The Amarillo silty clay loam is a very desirable soil for agriculture, and probably 85 per cent of it in the county is in cultivation. Where not cultivated it has a heavy growth of short grasses, mainly buffalo grass (*Bulbilis dactyloides*), some of the grama grasses (*Bouteloua* sp.), and others.

The principal crops are cotton, grain sorghums (milo principally), wheat, and sorgo. The yields in good seasons are approximately as follows: Cotton one-half to three-fourths bale, milo 25 to 50 bushels, and wheat 15 to 25 bushels. In dry seasons the yields are lower, and in seasons of more than normal rainfall much larger returns are obtained. Garden vegetables and fruit trees do well.

The soil has a light, friable tilth under cultivation. It does not drift badly in the heavy spring winds, retains moisture well, and where given reasonably good cultivation is quite resistant to drought.

Doubtless such crops as rye, barley, spelt, and broomcorn would do well on this type, as they are grown in various other counties on this soil. Sudan grass gives excellent yields on this soil in some localities, though very little is grown on the type in this county. Considerable numbers of hogs are successfully raised on the farms on this soil.

Improved farms composed of this soil were held at the time of the survey (1922) for $50 to $75 an acre.

RICHFIELD GRAVELLY LOAM, SHALLOW PHASE

The surface soil of the Richfield gravelly loam, shallow phase, consists of light-brown to whitish, very calcareous loam or clay loam containing a considerable quantity of hard and soft lime fragments of small size. Even where the color is brownish, the surface dries out to a very light gray. The subsoil, beginning at about 2 to 8 inches, consists of soft or partly hardened yellowish-white limy material. Some rather hard layers of white lime carbonate occur throughout this layer.

This is not a very definite soil. It is simply light-colored lime-carbonate material subject to severe erosion, and without much opportunity to develop soil layers. It is not typical of the dark-colored Richfield soils, but has been included with the series because of its small extent and its close association with the Richfield. This soil occupies small areas in the northwestern corner of the county as narrow fringes around the high plains soils, just where the escarpment starts to descend. Other small areas occur along the more gentle escarpments and on narrow spurs or small buttelike eminences reaching out from the escarpments. Much of it occurs along the steep escarpment, but here it is not shown separately on the soil map, being included with the Rough broken and stony land.

The surface is gently to steeply sloping, surface drainage is excessive, and erosion is active. In fact, the type owes its origin to erosion, the overlying soil material having been washed off and the limy layer thereby exposed.

The Richfield gravelly loam, shallow phase, is not cultivated, as it is a very thin poor soil. It supports a rather scant to moderately heavy growth of some grasses, chiefly broom sedge (*Andropogon scoparius*), and a small amount of buffalo and grama grasses.

RICHFIELD SILTY CLAY LOAM

The surface soil of the Richfield silty clay loam is a very dark brown to nearly black heavy silty clay loam, about 4 to 8 inches deep. This grades into a dark-brown to nearly black heavy clay, which extends to depths of about 20 inches, where it is underlain by chocolate-brown to dark reddish brown calcareous clay containing numerous soft, whitish lime particles. In places the lower subsoil has a salmon color. In some slight depressions the subsoil is a very dark brown to nearly black heavy clay, to depths of 36 inches with the soft lime carbonate layers appearing at depths of 4 to 6 feet. The soil and subsoil do not effervesce with acid.

The Richfield silty clay loam is very closely associated with the Amarillo silty clay loam, and the two types merge so gradually that

boundary lines must be drawn somewhat arbitrarily. In places there are numerous small spots of Amarillo silty clay loam in the areas of Richfield silty clay loam. These included patches, many of them only a few feet across, give a decidedly spotted appearance to freshly cultivated fields. The type also includes small lake beds of Randall clay and many small depressed areas which resemble lake beds.

The Richfield silty clay loam is a soil of moderate extent in Dickens County. It occurs with the Amarillo soils in the northwestern corner of the county on the High Plains in the vicinity of McAdoo. Reaching west out of the county, the type occupies large areas in other counties of the Staked Plains region.

The surface generally is flat, in some places very slightly depressed, and in other places very gently sloping. Surface drainage is very slow and water stands in many places until absorbed by the soil. This is an advantage, as the subsoil stores and retains a good supply of moisture for the crops, which yield remarkably well even in dry seasons.

The Richfield silty clay loam is a very desirable soil, and probably 85 per cent of it is in cultivation. The native vegetation consists of the short grasses, buffalo and grama predominating. The principal crops are cotton, grain sorghum (mainly milo), sorgo, and wheat. The yields of these crops are good, except in very dry seasons, when some crops on all soils may be injured. In ordinary seasons cotton yields about one-half bale, milo 25 to 50 bushels, sorgo 4 to 6 tons of fodder, and wheat 15 to 25 bushels per acre.

Improved farms on this land ordinarily sell for from $50 to $75 an acre. The distance to railroads has some effect in holding the land prices rather low.

RANDALL CLAY

The Randall clay consists of a nearly black clay with little change in color to a depth of 36 inches, except that dark bluish gray and rusty-brown mottlings are sometimes seen in both soil and subsoil. When dry both surface and subsoil have a dark bluish gray or ashy-black color. The surface layer of 3 or 4 inches is somewhat friable when dry. The greater part of the type does not effervesce with hydrochloric acid, except in some places in the lower subsoil, or in areas near slopes where material from the calcareous soils have been washed down. When dry the surface checks into long cracks several inches wide and several feet deep. Usually the surface is covered with the small, irregular hummocks and depressions known as "hog wallows." When wet the soil is very sticky, and when dry it bakes very hard and is broken up with difficulty.

The Randall clay is of very small extent. It occupies lake beds of 5 to 20 acres in size on the high plains and on the lower prairies, surrounded by the Amarillo silty clay loam or the Richfield silty clay loam. The areas are rather numerous on the High Plains, where one or two may be seen on nearly every section and sometimes more. These lake beds are known as "playa lakes." In the lower plains they are not as abundant as on the High Plains, but the soil appears to be the same in both regions.

The surface of the Randall clay is apparently perfectly flat. The small areas lie 1 or 2 feet below the surface of the surrounding soil

types, ranging from this up to 10 or 15 feet below where the areas are large. A few of the areas contain 30 or 40 acres. The drainage is, of course, very poor, as there is no outlet for the water in these depressions. In wet seasons water stands several feet deep over the surface. The greater part of the run-off water from the main areas of the high plains soils goes into these lakes.

The Randall clay is not utilized for farming and remains in pasture land. In many places where it is covered with weeds it is bare of grass vegetation. In some places considerable buffalo grass appears. The blue weed (*Helianthus ciliaris*), a serious weed pest, often grows thickly around the margin of the Randall clay. Owing to its small extent this land has no separate value, but it tends to lower the selling price of farm lands associated with it. Probably the soil is fertile, but it is difficult to work, and there is always danger of crops being lost through lack of drainage. A case has been reported where wells were sunk in these lake beds for drainage, and corn was planted which produced 65 bushels per acre.

DERBY FINE SAND

The Derby fine sand is a brownish-gray or yellowish-gray loose fine sand, passing at 6 to 8 inches into yellowish to pale salmon colored loose fine sand, which continues downward several feet below the 3-foot section. When dry the surface crusts slightly and the subsoil is very faintly hardened into clods which fall apart on handling.

This type occupies a few very small areas in the west-central part of the county along Duck and Dockum Creeks. It usually occurs adjacent to the stream bed. The surface is billowy to dunelike and is drifted into ridges and dunes by the wind. Drainage is good, as water sinks immediately downward through the loose soil mass.

In places the type is almost bare of vegetation, but usually there is an abundant growth of sagebrush (*Artemisia filifolia*), tall sedge grasses (*Andropogon* sp.), and sand bur grass. Patches of wild plum bushes are numerous. The type is not used for farming and has little value as an agricultural soil. It is too thin for any crops except perhaps small fruits and berries, and on plowing would drift so badly as to render crop growth almost impossible.

SPUR LOAMY FINE SAND

The Spur loamy fine sand is a chocolate-brown or light chocolate brown loamy fine sand, grading at 10 to 20 inches into light chocolate brown, grayish-brown, or salmon-colored loamy fine sand which extends to depths of several feet. The soil and subsoil are very slightly hardened when dry, but the material crumbles easily. It is strongly calcareous from the surface down.

This type occupies ribbonlike areas adjacent to Duck Creek and also appears in the Dockum Creek bottoms, in the west-central part of the county.

The type has a very gently sloping to flat surface, though in places slight billows and depressions show the effect of wind and water action. Surface drainage is naturally slow, but as the soil is permeable the water passes rapidly downward to the water table, which is rather near the surface even in dry seasons. The land is seldom

overflowed, as the bottom lands lie some 10 or 20 feet above the stream bed. Probably these lands are not overflowed on an average oftener than once in 15 years.

The Spur loamy fine sand is cultivated to a considerable extent, probably 60 per cent being used for farming. The native vegetation includes mesquite trees, chaparral bushes, sagebrush (*Artemisia filifolia*), and some of the grama and needle grasses.

The crops grown are cotton, corn, grain sorghums, and sorgo. The type is farmed with the Spur fine sandy loam. It is not as productive as the fine sandy loam. The soil drifts somewhat where unprotected. Owing to its rather light texture the soil gives only moderate yields, though it withstands droughty conditions very well. Cotton yields one-fourth to one-half bale per acre, corn 10 to 25 bushels, and sorgo 3 to 4 tons.

Land of this type constitutes only a small proportion of farms, and no definite value can be assigned to it.

The soil is somewhat deficient in organic matter, which should be supplied in the form of green-manure crops. Such treatment also will tend to prevent the soil from blowing.

SPUR FINE SANDY LOAM

The Spur fine sandy loam is a chocolate-brown or light chocolate brown fine sandy loam, underlain at about 6 or 8 inches by chocolate-brown to dark chocolate brown loam or heavy fine sandy loam, which locally becomes somewhat lighter in texture with depth and in places has a reddish-brown color. In some places the subsoil is a dark chocolate brown clay loam. Below 36 inches and locally at shallower depths light purplish red loamy fine sand occurs and extends several feet deeper. On approaching the boundary between this type and the lighter textured soils the texture becomes gradually lighter in both soil and subsoil, while the reverse is true where the type merges into the heavier types.

The entire soil mass is strongly calcareous. The soil and subsoil are both slightly hard where very dry, but break easily into a fine condition.

The Spur fine sandy loam is found in a number of areas in the Duck Creek, Dockum Creek, and Cottonwood Creek bottoms in the west-central, southern, and northern parts of the county. The larger areas are located north of Spur. The surface is practically flat or very slightly sloping. Drainage is good, as the soil is penetrable to water.

Although of relatively small extent, the type is rather important on a number of farms. Probably at least 75 per cent is in cultivation, the rest supporting a growth of mesquite trees, some chaparral, some sagebrush or wormwood (Pl. XII, fig. 1), and a heavy growth of short grasses, mainly grama and buffalo grasses. An occasional wild Chinaberry or soapberry tree (*Sapindus drummondi*) grows on this type, as well as on the other soils of this series.

The main crops grown are cotton, corn, the grain sorghums, and sorgo. Some wheat and oats are also grown. Cotton yields one-half to three-fourths bale on the average, and on one farm it has yielded one-half bale or more per acre each year during the last 10 years. Corn yields 25 to 50 bushels per acre, and milo, the principal grain

FIG. 1.—SOIL PROFILE SHOWING CALICHE LAYER OF LIME CARBONATE MATERIAL IN THE MILES FINE SANDY LOAM, ROLLING PHASE

FIG. 2.—FETERITA ON THE ABILENE SILTY CLAY LOAM

FIG. 1.—ARTEMISIA FILIFOLIA (SAGE BRUSH) ON THE SPUR FINE SANDY LOAM

The dark colored growth consists of mesquite and chaparral bushes

FIG. 2.—COTTON ON THE SPUR CLAY LOAM

This crop, which received no rain after June, produced one bale of cotton per acre

sorghum grown, yields 40 to 60 bushels per acre. Oats yield fairly good crops for such a light-textured soil. Wheat has produced 6 or 8 to 14 bushels per acre in very dry seasons and more when moisture conditions were favorable. Alfalfa is grown in a small way, yielding 3 to 4 tons per acre. Millet has been grown with good success. The soil is well suited to vegetables, fruit, and berries, and some of these crops are grown successfully in the small home gardens and orchards.

The Spur fine sandy loam is a productive and desirable soil. Its present selling value in farms, along with other good soils, is about $40 to $75 an acre.

There are some included areas of Spur very fine sandy loam which were not of sufficient extent to warrant separate mapping. The soil consists of chocolate-brown to light chocolate brown very fine sandy loam, about 8 to 12 inches deep, underlain by light chocolate brown or reddish-brown very fine sandy loam, which at depths of 24 to 30 inches becomes somewhat lighter in texture and more reddish in color. The lower subsoil usually consists of light purplish red loamy very fine sand. The soil and subsoil are calcareous and when very dry are slightly compact or hard.

This very fine sandy loam soil occurs in a few small areas in the central and southwestern parts of the county in the Duck River bottoms in the vicinity of Spur. The surface is level and drainage is good, as the light texture favors a rapid absorption of water.

This included type is a good soil for agriculture, and 75 per cent or more of it is in cultivation. The native growth is the same as on the fine sandy loam, and the yields of the common field crops are also approximately the same.

SPUR LOAM

The surface soil of the Spur loam is a light chocolate brown to dark chocolate brown loam, about 8 to 15 inches deep. The subsoil ranges in texture from loam or clay loam to friable silty clay, and in color from chocolate brown to salmon or reddish brown. Both soil and subsoil are calcareous. The soil bakes rather hard in dry seasons, but is easily broken up and worked into a seed bed of excellent tilth.

The Spur loam occurs in a number of small areas in the west-central part of the county in the Duck and Dockum Creek bottoms.

The surface is flat, and while surface drainage is slow it is not a hindrance to agriculture, as the water sinks readily downward and is stored in the substratum at shallow depths. Excellent water is obtained in wells at depths of about 12 feet. The type withstands dry conditions to a marked degree, resembling the other soils of the Spur series in that respect. In occasional spots, where the subsoil is rather light and consists of a fine sand, the yields are low because of droughty conditions.

Probably not less than 75 per cent of the type is in cultivation. The native vegetation includes mesquite trees and the short native grasses, such as buffalo and grama grasses. The same crops are grown and approximately the same yields are obtained, or perhaps slightly better in seasons of good rainfall, as on the Spur fine sandy loam. The soil is well suited to alfalfa, corn, cotton, and the other common crops of the region.

The Spur loam is a valuable and desired soil and is utilized on most farms for producing crops. It sells with the associated soils of the Spur series for $40 to $75 an acre, depending on location and improvements.

SPUR CLAY LOAM

The surface soil of the Spur clay loam is a chocolate-brown to very dark chocolate brown clay loam, ranging in places to a silty clay loam. This grades at 4 to 10 inches into a rather heavy but friable silty clay, which extends to a depth of 36 inches or more. The color of the subsoil varies somewhat with location; predominantly it is a rich chocolate brown, but in places it is dark chocolate brown. Locally the subsoil to about 18 inches is a very dark chocolate brown to nearly black silty clay, below which it is chocolate brown. In places the subsoil is reddish brown, while in other places the lower subsoil is brownish red. Here and there the lower subsoil contains considerable fine sand, making the texture a sandy clay or sandy clay loam. All the material of the 3-foot section is characteristically strongly calcareous.

Although baking to a hard condition during dry seasons, both soil and subsoil break into a fine cloddy structure without difficulty. The surface soil is sticky when wet, but under cultivation becomes a loamy mass, which is easily maintained in a condition of excellent tilth through any season. Even where uncultivated, the surface dries out into a mass of very fine granules.

The Spur clay loam, while not a very extensive soil type, is an important and valuable soil on many farms throughout the west-central and southwestern parts of the county. It occurs in small, narrow areas along Duck and Dockum Creeks, and is closely associated with the other alluvial soils of the Spur series along those streams.

The Spur clay loam is flat and in places occupies slightly depressed areas on the outer edge of the bottom lands adjacent to the uplands. In some places, along Dockum Creek, however, it has a very gentle, almost imperceptible slope streamwards, though more generally it occupies a very shallow trough. Surface drainage is therefore poor, but this is not a serious drawback in a region where the rainfall is not excessive. The soil absorbs water readily and there is a good store of underground water. In many places wells 10 to 20 feet deep on this soil afford a good supply of excellent water.

The Spur clay loam is a very important and valuable soil type in the county. It ranks among the highest in productiveness here and would rank high anywhere. Probably no less than 90 per cent of the type is in cultivation, the rest being used for pasture. The native vegetation consists of mesquite trees and a heavy growth of the native short grasses, mainly buffalo grass, grama grass, and some mesquite grass.

The leading crops are cotton, grain sorghums, and sorgo. Some farmers grow corn and some wheat and oats. Small patches of alfalfa are grown successfully. Even in very dry seasons good yields of these crops are made. Under favorable conditions cotton yields one-half to 1 bale per acre, milo 30 to 60 bushels, and sorgo 4 to 8 tons per acre. Corn yields 20 to 30 bushels per acre under

favorable conditions. Wheat and oats produce well, and if the plants get a good start the yields are fair even in dry seasons. In favorable seasons 15 to 25 bushels of wheat and 40 to 75 bushels of oats are produced per acre. The soil is especially suited for corn, cotton, and the grain sorghums.

This land is probably the most sought after of any soil. It sells at the present time for about $50 to $75 an acre in improved farms, and in especially favorable situations with good improvements the price is higher. Plate XII, figure 2, shows field of cotton near Spur that yielded 1 bale per acre.

MILLER VERY FINE SANDY LOAM

The Miller very fine sandy loam is a brownish-red very fine sandy loam, underlain at about 12 inches by somewhat heavier purplish-red very fine sandy loam. The soil and subsoil are both highly calcareous. In places the type as mapped includes patches of Miller very fine sand and Miller fine sand or fine sandy loam. Owing to the small extent of these soils they could not be shown separately on the soil map. An area of Yahola fine sandy loam occurring along the North Fork Wichita River was also included with the type. This differs from the soils of the Miller series in having a light sandy subsoil.

There are only a few small areas of the Miller very fine sandy loam in the county. These occur in the eastern part as narrow strips along the North Fork and South Fork of the Wichita River and along Croton and Dove Creeks and some of their tributaries.

The surface is flat, and water runs off slowly, but it sinks rapidly downward through the soil. Overflows are of rare occurrence, though the surface lies only a few feet above the stream bed.

Probably not over 5 per cent of this land is in cultivation. It is utilized in places for the production of grain sorghums, sorgo, and Johnson grass as feed for ranch stock. The native growth includes some mesquite trees, considerable sagebrush, some of the needle grasses and grama grasses, and in places sedge grass. The land affords excellent pasturage and is a very good soil for crops. Vegetables, berries, and fruits would also do well, and alfalfa would probably succeed.

MILLER CLAY LOAM

The Miller clay loam is a brownish-red clay loam about 8 inches deep, underlain by purplish-red to brownish-red silty clay. Both soil and subsoil are calcareous.

The type has only a small total area. It is developed in a few narrow creek bottoms in the northern, northeastern, and southwestern parts of the county. The surface is flat and drainage slow. Overflows are very uncommon.

The type is cultivated on some farms, though probably not more than half of it is in cultivation. It produces good yields of cotton, corn, grain sorghums, and sorgo. The soil is doubtless well suited to alfalfa. In its natural state it supports a growth of mesquite trees and several of the more important short grasses.

RIVERWASH

Riverwash includes broad creek-bottom areas where sand and gravel have been strewn by flood waters during periods of heavy rainfall. The soil is usually a gray, pale-yellow, or yellowish-gray fine sand to coarse sand, in many places containing a large proportion of rounded gravel, mainly of chert and quartz, with some other rock materials. In places there is some fine soil material that bakes rather hard.

Riverwash is ordinarily dry, the surface being covered with water only for very short periods of time during high floods. This soil is confined to the bottoms of Duck Creek north of Spur. Where narrow the creek bed is mapped as a stream of intermittent flow, but where the bed has a width of several hundred feet to nearly one-fourth mile the main area of the bed is mapped as Riverwash.

Riverwash is for the most part bare of vegetation, though rank grass and weeds grow sparsely here and there. The land is of no value for agriculture or for grazing.

ROUGH BROKEN AND STONY LAND

There are considerable areas of land in Dickens County too broken and eroded or too rough and stony for cultivation. The broken land comprises two main divisions—(1) the "breaks" or steep, broken, eroded areas along the edge and constituting largely the escarpment of the High Plains, and (2) the eroded and deeply dissected lands of the Red Beds, the main areas of which are locally termed the "Croton Breaks" in eastern Dickens County.

There are approximately 100,000 acres of this nonagricultural land in Dickens County, or nearly one-fifth of the total area of the county. This land is held in large tracts in ranches and had a value at the time of the survey (1922) of not more than $5 or $10 an acre. It is valued chiefly because the rough areas and canyons afford protection to the stock in winter, but considerable areas of good grass in the swales and narrow valleys and on ridge crests afford a surprising amount of grazing.

In some of the canyons springs afford a good supply of water for stock the year round. The supply is amplified by use of storage tanks and windmills where needed.

SUMMARY

Dickens County is located in northwestern Texas. It has an area of 893 square miles, or 571,520 acres.

The county is situated principally in the rolling red plains region, with the northwestern corner on the High Plains or Staked Plains. The elevation in the southern part of the county is around 2,300 feet above sea level, and is several hundred feet higher in the northwest section. The surface is rolling prairie, with a thin growth of small trees in many places, except in the northwestern section, which is a nearly level treeless plain. The general slope of the county is southeasterly. Several small streams adequately drain all parts of the county. The drainage of the southern part of the county flows into the Gulf of Mexico, through the Brazos River, and the Red River receives the drainage from the northern part.

Abundant drinking water is found on most farms at depths of 20 to 50 feet. Some of it carries gypsum and is not pleasant to the taste, but it is used by many. It is used for irrigating small gardens and for watering stock.

The population in 1920 was 5,876, all classed as rural. Spur is the most important town.

One railroad traverses the county, and some other lines are near the northern and western borders. The public roads are generally in good condition for wagon and automobile traffic, and some roads are gravel pikes in excellent condition.

The climate is mild, healthful, and invigorating. The average rainfall is not high—about 22½ inches—but comes mostly during the growing season. Total crop failures have not occurred generally, though yields are sometimes curtailed by extended periods of dry weather. The average frost-free season is about 207 days. The mean annual temperature is 61° F.

Ranching and farming are the main industries. Cattle raising is carried on extensively on large and some small ranches. The grain sorghums, sorgo (sweet sorghum), and cotton are the most dependable crops. Milo is the principal grain sorghum, although feterita is becoming important. Cotton ranks first in acreage and is the main cash crop. Many farmers grow a small patch of corn and some grow large acreages of wheat. Alfalfa is becoming a valuable crop in certain sections. The forage and grain are consumed on the farm and locally, though grain sorghum is shipped to outside markets in some years.

Dairying is practiced on a number of farms as an adjunct to general farming, and part of the cream is shipped out of the county. Hogs and poultry are raised extensively on small farms and shipped in carload lots.

Tree fruits in small home orchards, small fruits and grapes are grown universally, though late frosts are more or less destructive.

The methods of farming are based largely on the problem of conserving and utilizing the soil moisture to the best advantage, and the results have shown that it is possible to grow crops successfully with a lower precipitation than occurs in eastern Texas. The land is so newly opened to cultivation that the need of fertilizers or of practicing definite rotation of crops has not been felt.

According to the 1920 census, about 20 per cent of the land in farms, or about 15 per cent of the area of the county, is improved land. Most of the farms contain about 160 acres, though some are larger. There are some very large ranches and some of small size.

The material from which the soils are derived are unconsolidated or very slightly consolidated clays, silts, and sands, all more or less calcareous, ranging in age from Upper Paleozoic (Permian) in the eastern part to Tertiary or later in the northwestern part. Recent alluvial deposits also give some soils. The various types have developed under conditions of light rainfall.

The fine sandy loams and clay loams are the most extensive and constitute nearly all the arable soils of the county. A rather large percentage of the land in the western and southeastern parts of the county is too broken for cultivation.

The Miles series of soils covers the largest total area in the county. These are brown to purplish-red soils underlain by purplish-red subsoils of clay. They are derived, through weathering, from the unconsolidated sediments that cover a large part of the county. The Miles fine sandy loam, including its phases, is the most extensive soil in the county. The Miles soils are especially favorable for farming in a region where the moisture supply sometimes is deficient, and are well suited to the grain sorghums, sorgo, cotton, vegetables, and fruits.

The Vernon soils have purplish-red to dark reddish brown surface soils and a purplish-red subsoil. They are derived from the weathering of material derived from the Red Beds formation. The important types are the very fine sandy loam and the clay loam. The very fine sandy loam is a good soil, well suited to the general crops of the region, but it is very susceptible to erosion. It is not cultivated extensively, as it lies mostly in large cattle ranches. The clay loam is a strong soil suited to cotton, the grain sorghums, sorgo, and wheat, but crops on this soil do not withstand dry conditions very well.

The Abilene soils are dark-colored to nearly black soils with dark subsoils. They are suited to the general farm crops, but are not very extensively developed. The clay loam and fine sandy loam are the more important types, the loam and silty clay loam being of slight extent. These soils are probably suited to alfalfa, if carefully managed.

The Richfield soils, occurring on the high plains, are very dark brown to nearly black in the surface layer, and have a dark-colored subsoil. The Richfield silty clay loam is utilized largely for the production of grain sorghums, cotton, and wheat.

The Amarillo soils are high plains types with purplish-red soils and a purplish-red to salmon-colored subsoil. The silty clay loam is well suited to the general farm crops, including wheat. It is a strong soil and nearly all in cultivation.

The Randall clay occupies the beds of small intermittent lakes throughout the region. It is a heavy, dark soil, but is poorly drained and not cultivated.

The Cottonwood loam is a shallow soil underlain by gypsum beds. It has little agricultural value and is used only for grazing.

The Spur series is represented by types that have chocolate-brown to nearly black surface soils and a chocolate-brown subsoil. These are recent-alluvial soils of importance in the southern part of the county. They are rich and productive and valued by the farmers. The important types are the fine sandy loam and the clay loam. They are suited to the grain sorghums, sorgo, cotton, corn, and alfalfa.

The Derby fine sand occupies very small areas of gray fine sand, underlain by yellow fine sand. It drifts badly in heavy winds and is not cultivated.

The Miller soils are purplish-red alluvial soils, this color continuing to a depth of several feet. They are valuable agricultural soils, but are not extensive enough to be important in this county.

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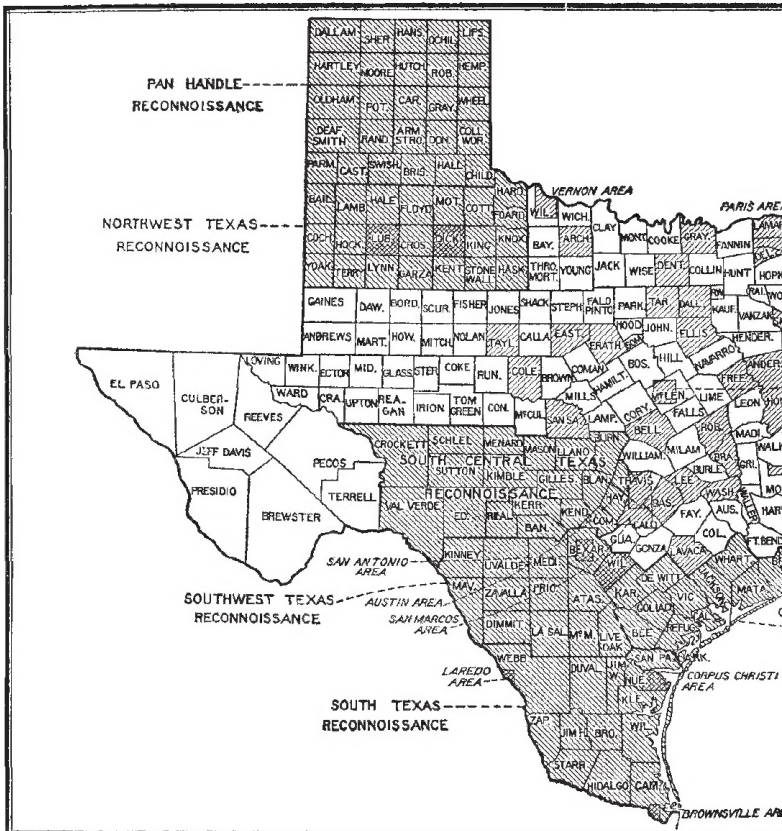

Areas surveyed in Texas, shown by shading

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(1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;

(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov.

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE
TEXAS AGRICULTURAL EXPERIMENT STATION

SOIL MAP

TEXAS
DICKENS COUNTY SHEET

LEGEND

- Abilene fine sandy loam — Af
- Abilene fine sandy loam, Shallow phase — Af
- Miller very fine sandy loam — Mv
- Miller clay loam — Mc
- Abilene loam — Al
- Randall clay — Rs
- Abilene clay loam — Ac
- Abilene clay loam, Shallow phase — Ac
- Richfield gravelly loam, Shallow phase — Rl
- Richfield silty clay loam — Rc
- Abilene silty clay loam — Ac
- Spur loamy fine sand — Sa
- Amarillo silty clay loam — Am
- Spur fine sandy loam — Sf
- Cottonwood loam — Cl
- Spur loam — Sl
- Derby fine sand — Df
- Spur clay loam — Sc
- Miles fine sand — Ms
- Vernon fine sandy loam — Vs
- Miles fine sand, Shallow phase — Ms
- Vernon very fine sandy loam — V
- Miles gravelly fine sandy loam — Mg
- Broken phase
- Miles fine sandy loam — Mf
- Vernon loam — Vl
- Miles fine sandy loam, Rolling phase — Mf
- Vernon clay loam — Vm
- Miles fine sandy loam, Depression phase — Mf
- Broken phase
- Miles clay loam — Ml
- Riverwash — Rv
- Rough broken and stony land — Rs

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines
- Boundary lines
- Boundary lines
- U.S. township and section lines

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Prominent Hills, Mountain Peaks
- Sand Wash and Sand dunes
- Shore and Low water-line, Sandbar

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

Soils surveyed by William T. Carter, in charge,
B. H. Hendrickson and W. W. Strike.

Scale 1 inch = 1 mile
1 ½ 0 1 2 3 4 Miles

A. Hoen & Co. Lith., Baltimore, Md.

Field Operations
Bureau of Soils
1922